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NONE FOR
1945

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of contents
for 1946.

THE **ANNUAL
REPORT
1944**

NORTHEASTERN FOREST
EXPERIMENT STATION



NORTHEASTERN FOREST EXPERIMENT STATION
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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

NORTHEASTERN FOREST EXPERIMENT STATION

In cooperation with the University of Pennsylvania
614 Bankers Securities Building
Philadelphia 7, Pennsylvania

Hardy L. Shirley, Director

On January 1, 1945, the Chief of the Forest Service formally assigned to the Allegheny Forest Experiment Station responsibility for all Forest Service research activities in New England, New York, Pennsylvania, New Jersey, Delaware, and Maryland. He also directed that henceforth the research be done under the name of the Northeastern Forest Experiment Station, as this more fittingly refers to the territory covered. These changes were made to comply with a formal request by the Allegheny Forest Research Advisory Council.

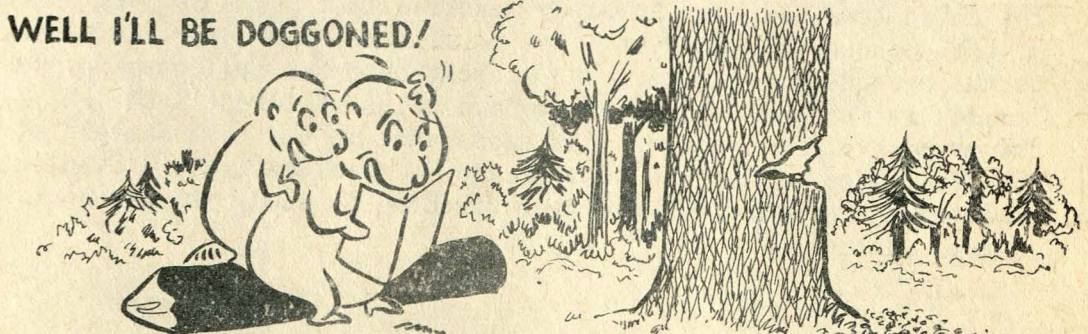
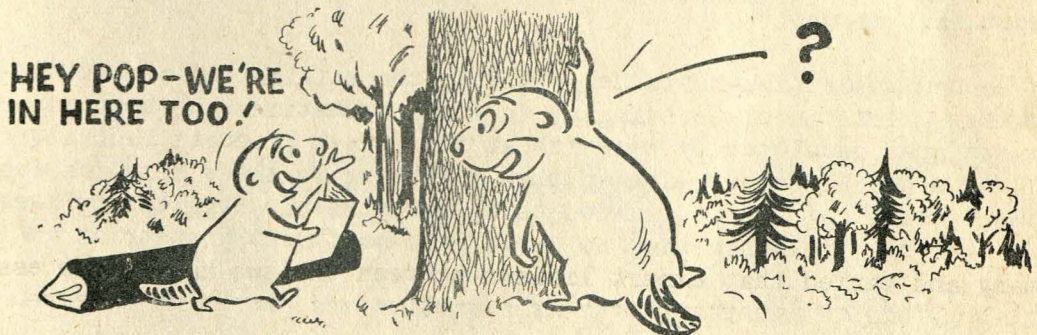
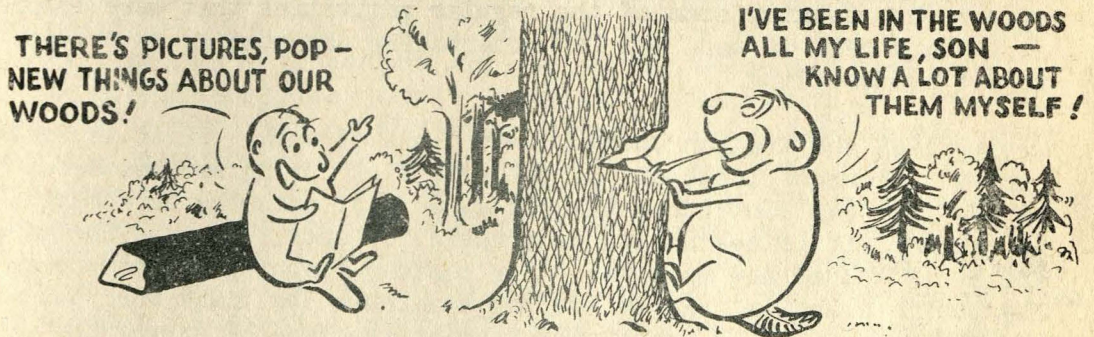
TABLE OF CONTENTS

Section I

	Page
Joe Beaver cartoon	3
Foreword	4
New uses for Northeast timber	6
Molded plywood fits wood for new principles in construction	7
Good cutting practice strengthens forest cooperative	8
Forestalling decay losses in balsam fir	10
Predicting future pulp yields from woods run spruce land	12
Applied forestry can help to lick the gypsy moth	14
Will unemployment again plague the anthracite region of Pennsylvania?	16
The forest situation in the anthracite region	18
Sawmills and lumber production	20
Northeast sustains wartime lumber cut of 1.8 billion board feet	22
Will logging lose its glamour?	24
Portable power saws	25
Thinning for chemicalwood pays	26
Man-caused frost pockets in plateau forests	28
To revegetate that sterile cut or raw bank use mulch	30
Protective coatings are cheap planting insurance	32
Fire danger varies by fuel type	34
Design for the Northeast forest survey	36
Hardwood lumber products and prices at small sawmills	38
Monthly trends in Northeast lumber production	40
Factors impeding increased lumber production	41
War depletes lumber stocks	42
A preview of future research results	43
Does selective cutting of northern hardwoods pay?	44
Birch hybrids may afford better turning stock	46
Sweeter maples for the sugar bush	48
List of publications	50

FIRST -- THE LIGHTER TOUCH

With this issue of the Annual Report we are pleased to introduce Joe Beaver, an experienced woodsman, and Joe Jr., anxious to follow in the family tradition. Their ancestors have "lived off the woods" from time immemorial.



It may be YOU'RE not in here
But perhaps you WILL find something of interest

SEE PAGE 5

ANNUAL REPORT OF THE
NORTHEASTERN FOREST EXPERIMENT STATION

As America enters her fourth year of war, much of the hysteria and excitement that marked home front activities during the first year have subsided. Gradually we have come to the sober realization that patriotic fervor, blackout drills, and bond drives will not bring victory without unremitting toil on farms, in factories, and offices. Labor shortages have placed a premium on training people in new skills, in work simplification, and in new ways of doing jobs that will save material and personnel. Research in wartime makes a big contribution to these tasks. Used at first largely as an information service for other war agencies, forest research has gradually been given advisory and training functions. During the past year even greater need has arisen for resuming some of the regular activities that were dropped at the outbreak of war, and for undertaking new studies to protect our forest productivity.

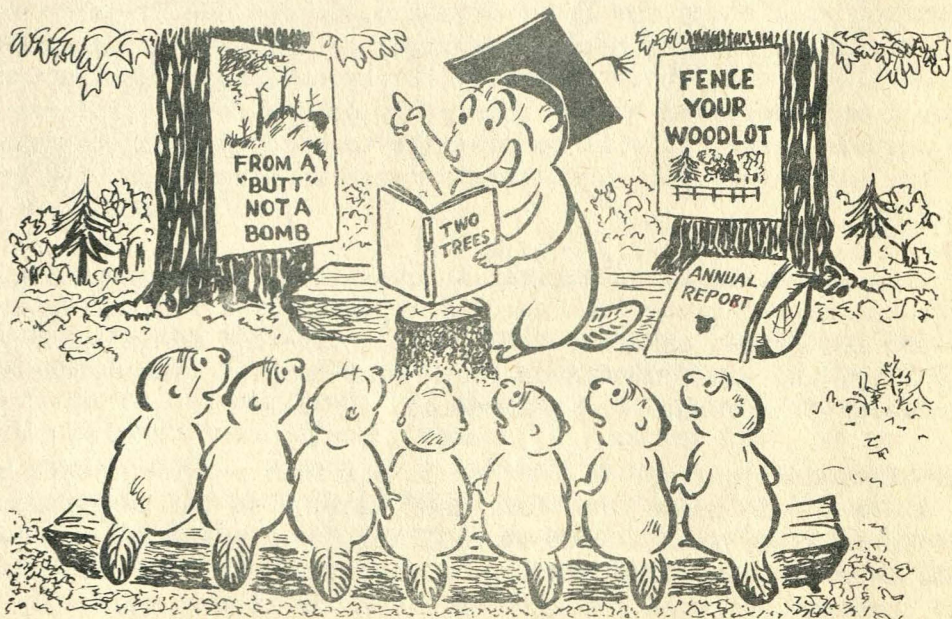
During 1944 the Station opened 3 new lines of work. First is Forest Survey. Accurate knowledge of the extent of our forest resources and of how they can contribute towards support of industry is constantly in demand. It is needed now as a basis for obtaining wood for war; and it is needed now as a basis for postwar planning by industries and public agencies. Funds are not available for field work but special effort is now being made to plan the type of survey the Northeast needs.

A second major task is to help improve the utilization of Northeast timber. This involves bringing to local industries the best modern techniques developed by research at the Forest Products Laboratory in Madison and elsewhere, and in turn referring to these research centers the problems of northeast wood-using industries. Progress by research men in this field has been so rapid, and northeast industries are so many and varied that expert liaison between the two has become essential. This is important both as a wartime and peacetime measure.

The third task has been to study measures that might lead to control of the spruce budworm or at least to minimize the damage it causes to the spruce-fir forests. The present outbreak now sweeping over Canada has ravaged some 65,000 square miles of forest land. It is the most severe on record. Its appearance in the northeastern states is anticipated within the next decade. Consequently, the Station and other research agencies have been directed to study all practical control measures.

During 1944 the Station, cooperating with other agencies, completed preliminary postwar plans for forestry and forest research for the Northeast. This work covered the general forest resources and their potentialities, outlined needed remedial measures, but did not blueprint action programs. Reports on this work were issued. Broad plans for research were outlined and discussed with forestry leaders. Early termination of the war therefore will not find the Station unprepared for the transition period. We still have before us, however, the preparation of detailed plans for new work and for development of new experimental areas. This is a job for the years ahead.

The popular section of the 1943 Annual Report of the Allegheny Forest Experiment Station received widespread approval. Issued originally in 300 copies, a total of 1500 were finally distributed. We still have a few copies left, and we still have requests coming in. Many readers have urged that the 1943 report be made a model for future ones. This report therefore repeats last year's style. It contains one additional feature, the Joe Beaver cartoons. These grew out of the Station's effort to explore new techniques for getting forestry measures across to timberland owners. Among those employed were public opinion analyses, window displays, posters, and cartoons, in addition to the usual leaflets and bulletins. The most popular have been the cartoons. A few are worked into this annual report to illustrate how even matter-of-fact, scientific reports can be made to catch the reader's attention. A booklet of Joe Beaver cartoons and a special booklet of linoleum cuts entitled "Two Trees" are scheduled for early release in 1945. The Station welcomes comments from everyone on these new methods of teaching important lessons in forest conservation.



NEW USES FOR NORTHEAST TIMBER

Scientists, industrialists, and journalists are heralding a new age of wood. This era has already dawned in Europe where wood gas drives motor vehicles, hydrogenated lignin lubricates them, wood wool is used for clothing, wood fodder for cattle feed, and wood sugar for "aquavit". Besides these remarkable products conversions, many somewhat more commonplace products possibilities are emerging from technological research, partly war-induced, of recent years. These are creating new commodities, new products, and new industries.

Industries of our Northeast are eager to exploit these new possibilities. Boat builders have asked, Can loblolly pine be treated to make it equal or superior to cedar and cypress in decay resistance and dimensional stability? A sash and door manufacturer wants to know if dipping sash in preservatives is worth while to increase resistance to decay. How can maple last blocks be dried to cut down degrade losses? Can red oak be treated to make it suitable for tight cooperage? How much does it cost to equip a pilot plant for making fodder yeast from sawdust and shavings? What equipment is needed for making laminated timbers for farm buildings?

These are a fair sample of the specific inquiries now reaching the Station's new Division of Forest Utilization set up since the beginning of the current fiscal year. The new division will function as a channel through which information on new techniques for the manufacture and for the use of forest products can more readily find its way into practical use in the wood-using industries.

Using the Forest Products Laboratory as its basic source of information and technical guidance, the staff assigned to the Utilization Division will study the needs of the 6,000 wood-using enterprises in the Northeast, supply needed technical or economic information which is available and, where necessary, block out new investigations which should be undertaken by the Laboratory or some other research agency. In certain cases, it will be possible to have specialists detailed by the Laboratory for short-term service in connection with special problems.

Special attention will be given to questions having statewide or regional significance such as: Is a pulp mill a logical enterprise to use low grade Connecticut hardwood? Will new demands for veneer, flooring, and small dimension stock make feasible the harvesting of hardwoods from remote areas in Maine?

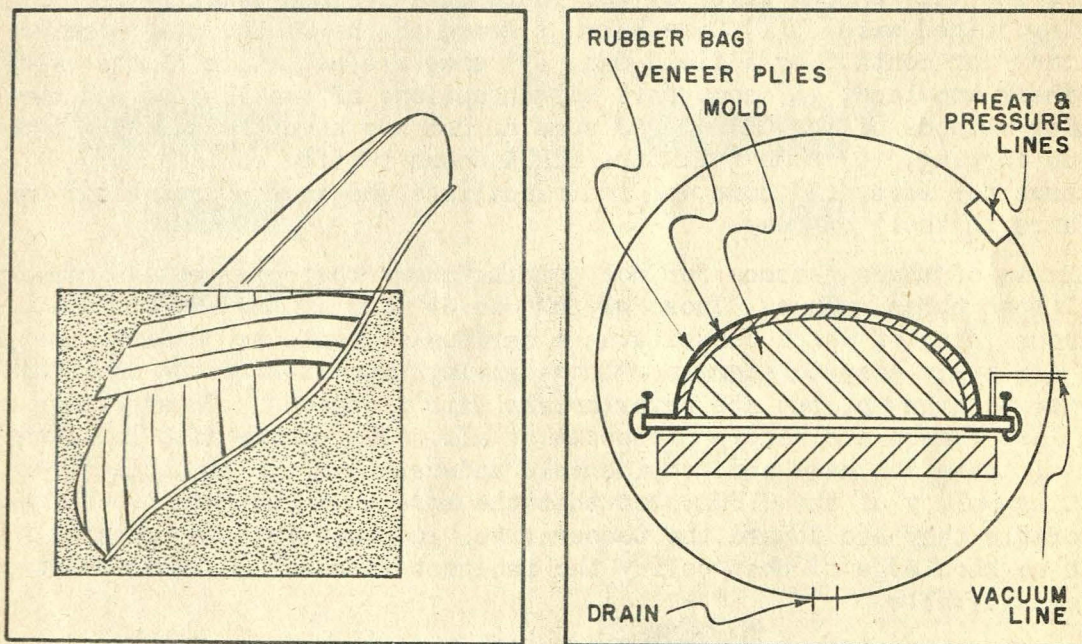
The Station is anxious to render all possible service toward reducing this new knowledge to practical use. Inquiries and suggestions from industrialists, sawmill operators, logging contractors, and foresters will be given careful attention. Cooperation by trade associations and consumers of wood products of all kinds is also earnestly desired.

MOLDED PLYWOOD FITS WOOD FOR NEW PRINCIPLES IN CONSTRUCTION

Compound curvatures and one-piece assemblies by mass production schedules are now possible through use of the new bag molding techniques. This principle has found wartime application in construction of training and fighter planes, gliders, and PT-boats. Tomorrow it may be used to build new types of furniture, small pleasure boats, motor vehicles, and railway coaches.

The important new feature of molded plywood is the unit or monocoque type of structure perhaps best exemplified by the welded steel cargo vessel. Instead of depending for strength on a massive and intricate framework to which the covering is attached, frame and cover are all bonded together. Through making the cover an integral part of the whole, the frame is redesigned and made much lighter. Compound curvature in itself adds greatly to stiffness. Strength and stiffness can be further increased by introducing a thick layer of light balsa wood between inner and outer plywood coverings. This sandwich construction is particularly valuable in aircraft.

Canoe construction affords a simple example:



The molding process consists of four major steps: (1) laying veneer plies at right angles to each other on a form prepared to the exact shape and dimensions required; (2) placing a waterproof, phenolic resin glue between each layer of veneer; (3) curing the glue in a tank or chamber with the part in a protective rubber or plastic bag; and (4) removing the part in 10 to 20 minutes ready for finishing operations. The Station can now give technical assistance to industries in northeastern states interested in molded wood construction.

GOOD CUTTING PRACTICE STRENGTHENS FOREST COOPERATIVE

About a quarter of the 60 million acres of timberland in the Northeast is in small farm woodland tracts where intensive forestry is practicable provided the 400,000 farmer-owners themselves can be interested. One way to build up this interest and at the same time make small-scale intensive forestry economically possible is by means of the forest cooperative. That this approach is effective is shown by the results of a public opinion survey recently made by the Northeastern Station of the attitude of local farmers toward the Otsego Forest Products Cooperative Association of Cooperstown, New York. Indeed, it was found that the good forestry practices of the OFPCA were the best liked feature of the Association.

Interviews with 100 representative members revealed the following: Three-quarters of the members are favorable toward the OFPCA. About half of them, however, have some criticism to make of its marketing practices, largely because of misunderstanding of log grading and scaling. On the other hand, insofar as they understand it, they approve heartily of the Association's selective cutting policy; and the greater their understanding, the more favorable their attitude toward the OFPCA.

The principal reasons given by 102 representative non-members for not having joined were: (1) Some haven't heard of the OFPCA; (2) some are waiting for contact by a field man; (3) some are not aware of the value of their woodland; (4) some have misconceptions of the logging and marketing methods of the OFPCA; (5) some do not now have the time and labor to do logging; (6) some think the OFPCA doesn't offer satisfactory returns for logs; (7) some are individualists who want to run their own affairs in their own way.

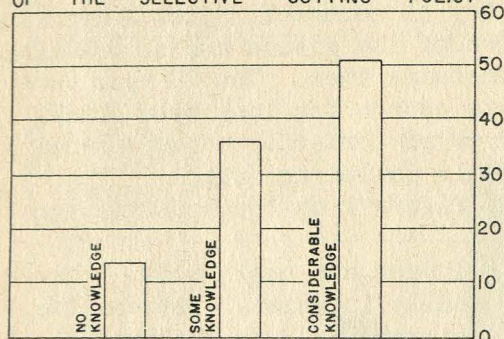
Analysis of these reasons for not joining shows that prospective members fall into three groups. Those giving one or more of the first five reasons, none of which constitutes a serious obstacle to joining, should be relatively easy to sign up. Those giving the sixth reason would be harder to sign up, but are nevertheless fair prospects. Those giving the last reason are hardly prospects at all. The survey also found that few of these men have any considerable understanding of the selective cutting policy of the OFPCA; but that the more they know of it, the more favorable they are toward the Cooperative; and that even among those with no knowledge of that policy the interest in woodland improvement is considerable.

These findings indicate that an educational program is needed to acquaint both members and non-members more fully with the grading, scaling, and marketing practices of the OFPCA, and to widen the understanding of the selective cutting policy. It is also clear that there is a large prospective membership; and that exposition of the selective cutting policy should be the central feature of any membership campaign.

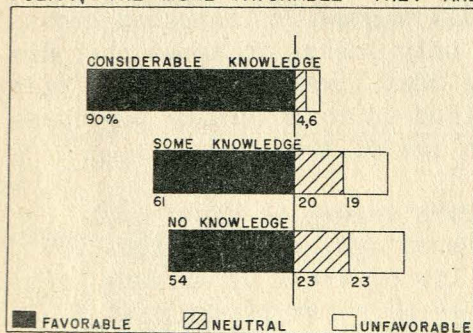
If the attitude of the farmers interviewed in this survey is any indication of the attitude of farmers in the Northeast generally, it would appear that interest in woodland improvement is already widespread and that forest cooperatives will be wise to feature good forest practice as one of their important services.

FARMERS FAVOR SELECTIVE CUTTING

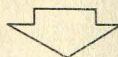
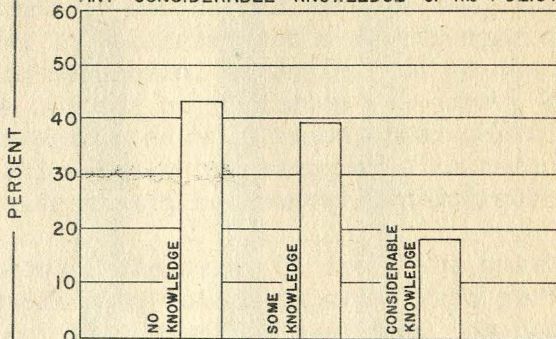
MOST MEMBERS HAVE SOME KNOWLEDGE OF THE SELECTIVE CUTTING POLICY



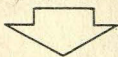
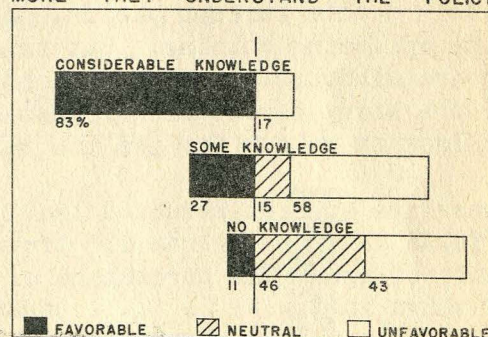
THE MORE THEY UNDERSTAND THE POLICY, THE MORE FAVORABLE THEY ARE



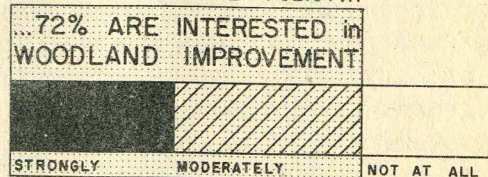
VERY FEW NON-MEMBERS HAVE ANY CONSIDERABLE KNOWLEDGE OF THE POLICY



BUT THEY ARE MORE FAVORABLE THE MORE THEY UNDERSTAND THE POLICY



FURTHERMORE, OF THE NON-MEMBERS WHO HAD NO KNOWLEDGE OF THE POLICY...



THEREFORE
EXPOSITION OF THE
SELECTIVE CUTTING POLICY...

- WOULD STRENGTHEN MEMBER SUPPORT

- WOULD WIN NEW MEMBERS

FORESTALLING DECAY LOSSES IN BALSAM FIR

Average yields from second growth spruce-fir forests of the Northeast are only about five cords per acre. This represents an average growth of scarcely one-tenth cord per acre for the 60-year interval between cuttings. A special feature of the study of spruce-fir yields described on page 12 was a determination of causes of low yields and of practical measures that might be introduced to increase them. The 20-year record of growth and mortality on the 100 plots chosen for long term study enabled us to build up with a high degree of certainty a table showing losses to be expected at various intervals following cutting. The information is presented graphically in figure 1 on the opposite page.

During the first 20 years after cutting losses are negligible. Thereafter they begin at a slow rate and gradually increase. Between the 30th and 40th year 1.2 cords are lost; between the 30th and 50th, 4.1; and between the 30th and 60th, 6.2 cords. In other words, harvesting on a 60-year cutting cycle means harvesting only about 50% of the timber grown. A 30-year cutting cycle would make possible recapturing 3.6 cords of growth, and a 20-year cycle, 4.2 cords. This would approximately double current yields, making no allowance for increased growth rate following cutting. But this covers only losses in trees that die or are windthrown. What happens to those that live? To get this side of the story forest pathologists were called in to determine the cause of loss in balsam fir and its relation to age of tree.

Extensive studies revealed that decay severe enough to cause cull affects half the balsam fir trees 72 years of age, and all trees 165 years of age. The percentage of cull in living trees of various ages is shown in figure 2. Cull begins in trees 40 years of age. At 60 years it reduces merchantable volume by 10%, at 100 years by 22%, and at 140 years by 40%.

Long cutting cycles to which these losses can be directly attributed represent far more than decreased yield from the land. They involve also increased logging costs because of windthrown and broken trees that must be cleared from sled roads, and the extra labor required to cut out hidden cull from sound wood. Costs are probably further increased by the necessity of abandonment and replacement of logging improvements and by the necessity of carrying operations on twice the acreage that otherwise would be necessary. These added costs can go far towards offsetting any extra costs involved in the slightly lower average cuts per acre required in short cutting cycles.

The short cutting cycle has the further advantage of favoring spruce over fir, of removing favored food trees of the spruce budworm, and of promoting thrifty stands that can best weather budworm attack.

FIGURE 1

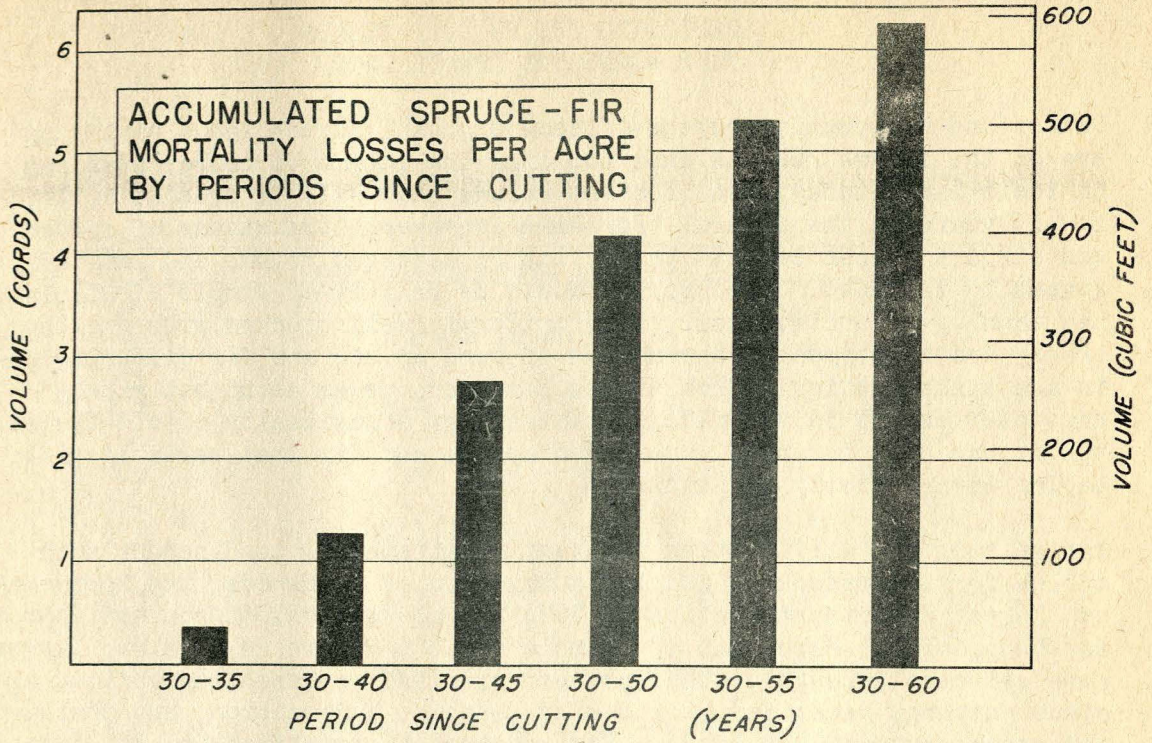
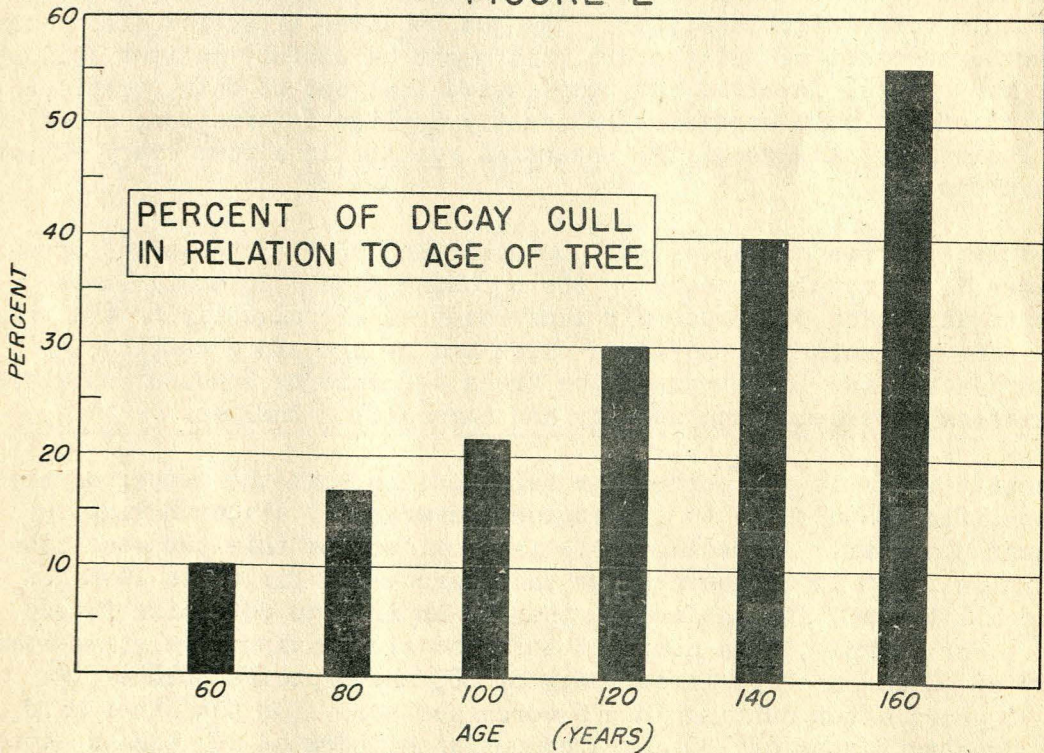


FIGURE 2



PREDICTING FUTURE PULP YIELDS FROM WOODS RUN SPRUCE LAND

Owners and prospective buyers of second growth spruce lands having an eye on the future need to know not only the volume of timber standing on their lands today, but also the volume that will be present 5, 10, and 15 years in the future. For example, overmature stands of spruce and fir are almost certain to decline in cordwood volume and immature stands to increase. The problem would be relatively simple if all lands had equally productive soil, were uniformly well stocked with growing trees, and if stands were composed of pure spruce and fir differing only in age since cutting. Such stands foresters dream about but rarely encounter except in man-made plantations or occasionally on old fields. Yet it was only for pure, even-aged spruce and fir that reliable yield tables were formerly available.

Recognizing the difficulties inherent in attempting to discount such tables for understocking and for admixtures of hardwoods, the Northeastern Forest Experiment Station in 1924 set about developing a new approach to the problem. More than 400 sample areas $1/8$ -acre in size and larger were selected throughout the spruce region and representing various ages since cutting, densities of stocking, species composition, and dominant and secondary softwood lands. The growth data from these plots, together with that obtained over a 15-year period through remeasurement at 5-year intervals of approximately 25% of the original 400 plots, was subjected to multiple correlation analysis. The job required extensive field work, precise measurement of all factors that might be useful, patient follow-up for many years, involved and complicated analyses of data, critical selection of the most pertinent and easily applied information, and finally, lucid presentation of the essential results in a form every skilled woodsman can apply.

The complete series of tables will be published in a "Handbook of Spruce Management". A sample appears on the opposite page. To apply these tables to any tract of spruce-fir land requires (1) classifying the tract by dominant and secondary softwood sites and by age since cutting; (2) sampling each class to determine the trees per acre by species and diameter classes; (3) computing density and composition indices.

The density index is the percentage relationship that the number of trees in a specific stand bears to the regional average of stands having the same mean diameter. A special table is provided for this purpose. The composition index is the percentage that spruce and fir trees combined bear to all trees. The tables can then be applied to determine future yields. For example, in a dominant softwood site having a relative stand density of 90 and a composition index of 60, the expected spruce-fir yield 30 years after cutting is 5.9 cords per acre. On the other hand, with a density factor of 150 and a composition index of 80, the expected yield is 8.2 cords per acre, an increase of nearly 40 percent. (See yield table on opposite page).

SAMPLE TABLE

30 years after cutting

Density (percent)	Composition index (percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10	2.1	2.5	3.0	3.4	3.8	4.3	4.7	5.2	5.7	6.2
30	2.5	2.9	3.3	3.8	4.2	4.7	5.1	5.6	6.1	6.6
50	2.8	3.2	3.7	4.1	4.6	5.1	5.5	6.0	6.5	7.0
70	3.2	3.6	4.1	4.5	5.0	5.5	6.0	6.5	7.0	7.5
90	3.6	4.0	4.5	4.9	5.4	5.9	6.4	6.9	7.4	7.9
110	3.9	4.4	4.9	5.3	5.8	6.3	6.8	7.3	7.8	8.3
130	4.3	4.8	5.3	5.7	6.2	6.7	7.2	7.7	8.3	8.8
150	4.7	5.2	5.7	6.1	6.7	7.1	7.7	8.2	8.7	9.2
170	5.1	5.6	6.1	6.6	7.1	7.6	8.1	8.6	9.2	9.7
190	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.1	9.6	10.1
210	5.9	6.4	6.9	7.4	7.9	8.5	9.0	9.6	10.1	10.6
230	6.3	6.8	7.3	7.9	8.4	8.9	9.5	10.0	10.6	11.0
250	6.8	7.3	7.8	8.3	8.8	9.4	9.9	10.5	11.0	11.5

APPLIED FORESTRY CAN HELP TO LICK THE GYPSY MOTH

In the better hardwood forests with an undisturbed and well developed forest floor, the gypsy moth is not a serious pest. The insect finds its most favorable environment for an abundant life in open, under-stocked forests with shallow litter and sparse undergrowth -- the inevitable consequence of poor forest practice.

Studies in the Northeast during the past few years have revealed the forest conditions (resulting from forest practices, good and bad) that are commonly associated with low and high populations of the insect.

LOW POPULATIONS ASSOCIATED WITH:

Dense, well-stocked stands

Little or no evidence of recent fires or grazing

Deep, relatively loose leaf litter

Predators and parasites of the gypsy moth abundant

Litter relatively cool and moist during the larval period

THESE CONDITIONS ARE
ATTAINABLE BY
GOOD FOREST PRACTICE

HIGH POPULATIONS ASSOCIATED WITH:

Open, under-stocked stands

Evidence of frequent burning or heavy grazing

Scattered or shallow leaf litter

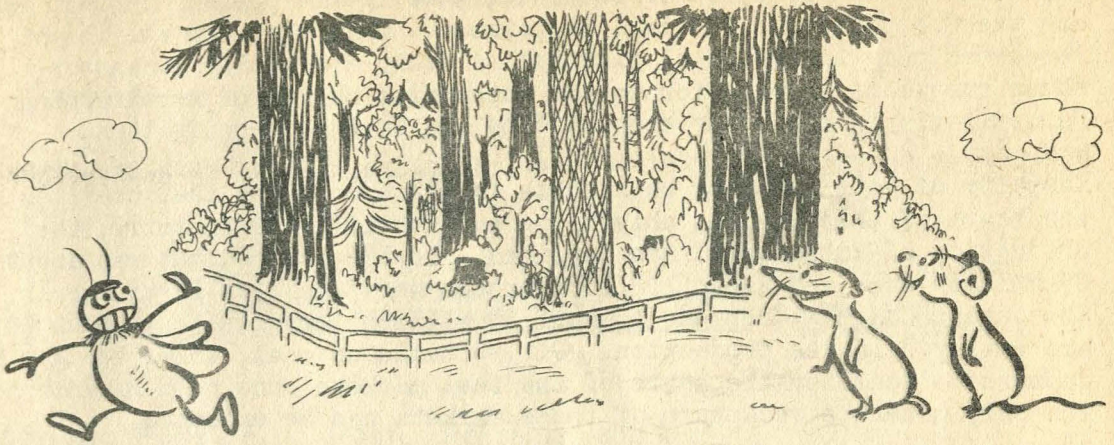
Relatively few predators and parasites of the gypsy moth

Litter relatively warm and dry during the larval period

TO GET THESE CONDITIONS
SIMPLY APPLY
POOR FOREST PRACTICE

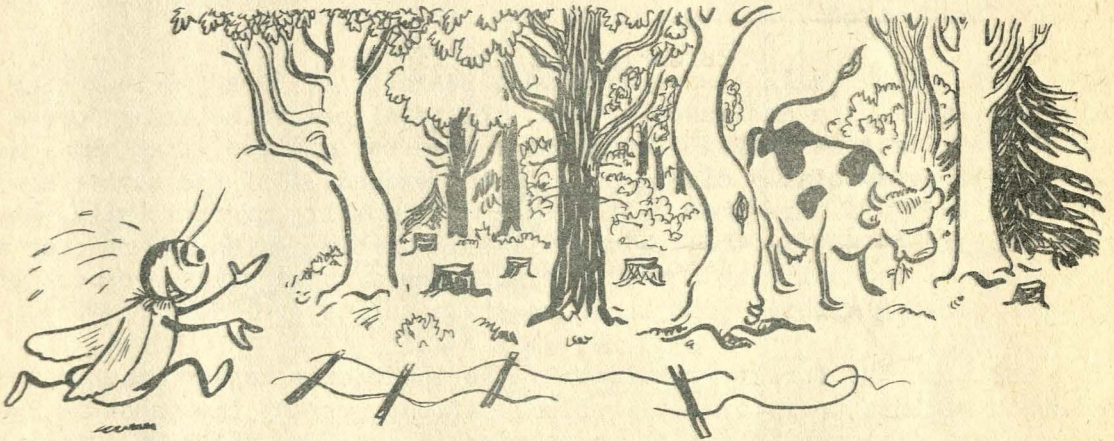
Severe drought, especially during June and July, may create conditions unfavorable to many of the parasites and predators, and thus favor the increase of the moth within regions and in forests where the insect normally persists at a relatively low population density. Man cannot control the weather -- but a good forest can withstand the infrequent and relatively short epidemics that might result from abnormally dry years. Good forest practices on thin, dry soils build up litter conditions favorable to moth enemies.

FOREST OWNERS NEED GOOD FORESTS!



In a good hardwood forest conditions are favorable to predators such as shrews and mice and to parasites of the moth. These keep the insect in check.

THE GYPSY MOTH NEEDS POOR FORESTS!



Open, understocked stands resulting from forest fires, repeated clearcutting, and grazing are unfavorable to the enemies of the gypsy moth. Such stands invite heavy outbreaks.

WHY RAISE GYPSY MOTHS?

This insect is essentially a pest of poor woodlands and of park and roadside trees. Such has been its history since its appearance in America over half a century ago. Good forest practices will tend to reduce the gypsy moth menace in our hardwood timber stands.

WILL UNEMPLOYMENT AGAIN PLAGUE
THE ANTHRACITE REGION OF PENNSYLVANIA?

What will the labor force of the country be in the postwar period? What are the prospects for its full employment? What part can the forest resources play in the total picture? A study attempting to answer these questions in relation to the Anthracite Region of northeastern Pennsylvania is now being completed by the Northeastern Station.

Scarcity of jobs has long been acute in the 6 counties that comprise the heart of this region, chiefly because their major industry, the production of anthracite, has declined. In 1924 the output was about 85 million tons and about 158,000 persons were employed in mining it. The output has now dropped to about 60 million tons and only about 80,000 are employed in its production. Oil, bituminous coal, coke, and gas have captured a considerable share of the fuel markets once held by anthracite and only moderate recapture of those markets can be expected.

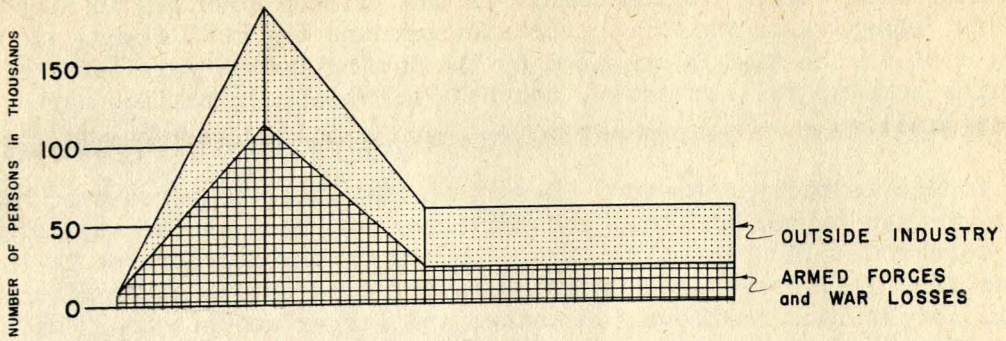
At the moment there are jobs enough to go around. But in 1940, after ten years of serious unemployment and an outward migration of 99,000 persons, there were still 145,000 -- 30% of the labor force -- unemployed or supported on public emergency work projects. The war has brought an increase in manufacturing and trade and service employment of about 20,000; about 113,000 have entered the armed forces; and another 74,000 have gone elsewhere to work in war industries. As a result unemployment has temporarily disappeared.

But after the war will there again be a scarcity of jobs? Calculating from available data and assuming that the total peacetime armed forces of the United States will not require more than two million; that war losses, including those totally disabled, will not exceed 3% of the number now in service; that not more than half of the war-industry migrants will return, that employment within the region will hold wartime gains and recover wartime losses; one still is confronted with the discomfiting prospect of 100,000 persons without jobs in these six counties by 1950.

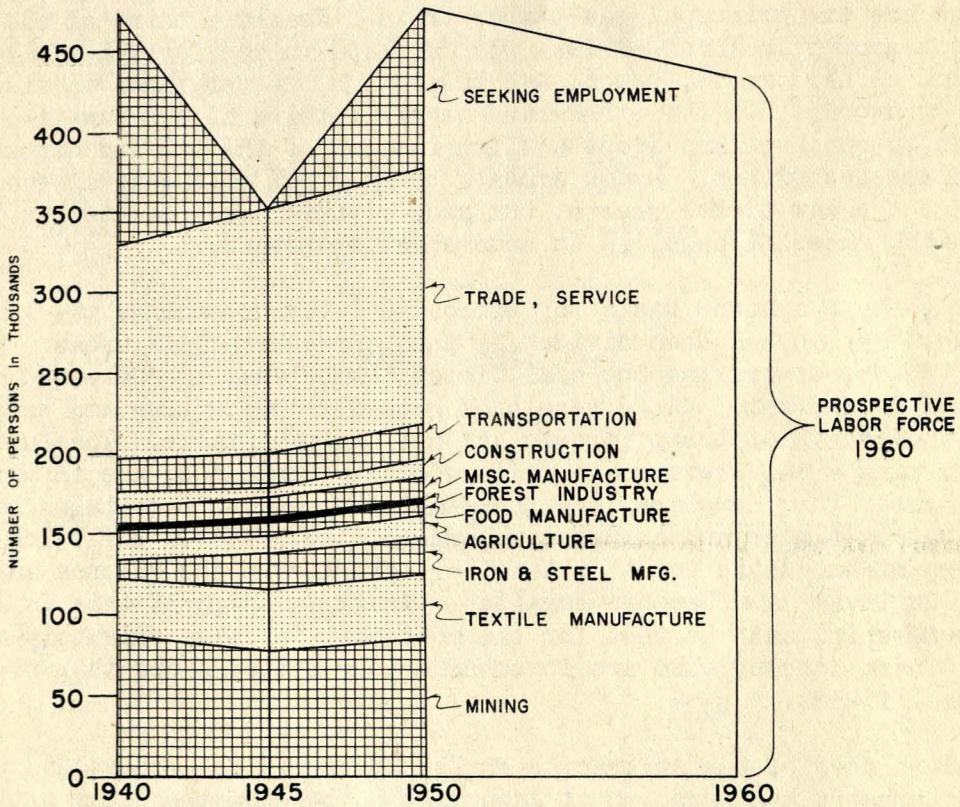
What part can the forest resources of the Anthracite Region play in the solution of this unemployment problem? At the present time about 6,000 persons are employed in forest industries in the 6 counties in question and in the 9 surrounding counties. But the forest resources that support these industries are in very poor condition. With good forest management they could eventually be built up to support employment for 30,000. A region-wide rehabilitation program to achieve this end could provide employment for about 5,000 persons annually for 5 years. Since the Anthracite Region is adjacent to one of the largest and best wood-consuming markets of the world, this program is economically justifiable in the long run. At the same time it would contribute in a small way to the solution of what is bound to be a serious unemployment problem in the near future.

The figure in the middle of the opposite page presents an analysis of the employment situation in the 6 counties as it was in 1940, as it is now, and as estimates show it may be in 1950 and 1960. The figure at the top of the page shows the drain on the labor force due to the war. The figure at the bottom of the page shows the part that forest rehabilitation can play in providing employment in 1950.

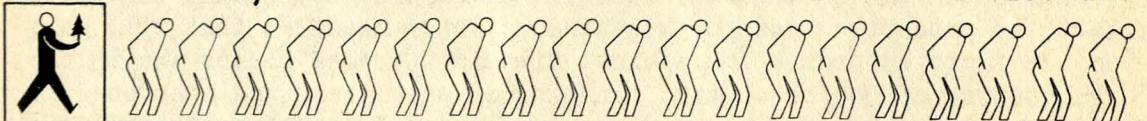
LOSS TO THE ARMED FORCES AND OUTSIDE WAR INDUSTRY



LABOR FORCE Past, Present, and Future



IN 1950, 100,000 PERSONS MAY BE SEEKING EMPLOYMENT



5,000 of these CAN BE EMPLOYED in
FOREST REHABILITATION

EACH SYMBOL REPRESENTS 5,000 PERSONS

THE FOREST SITUATION...

The Anthracite Forest Region comprises the fifteen counties in northeastern Pennsylvania which include and surround the coal fields and from which most of the timber required by the mining industry is obtained. It contains some $5\frac{1}{4}$ million acres, the bulk of which, $3\frac{1}{4}$ million acres, is forest land.

This forest is badly depleted. Less than 200 thousand acres bear merchantable saw timber and only an additional 600 thousand acres, merchantable cordwood. The remaining three-fourths of the forest area is in stands generally considered unmerchantable. The total volume of wood on all forest land in trees 5.0 inches and larger amounts to 37 million tons. Nearly half of this is in unmerchantable stands. Valuable species predominate. Red oak, red maple, white oak, beech, and hemlock contain more than half the cubic foot volume. Hemlock, white pine, beech, and white oak are the principal saw-timber trees. Nearly a third of the cubic foot growth is in oaks, less than a fifth in conifers, a similar proportion in hard maple, beech, and birch, and the remainder in miscellaneous hardwoods. On the other hand nearly a third of the saw-timber growth is in conifers and about a fifth in each of the oak and northern hardwood species groups. Drain amounts to only 64% of the total growth and 91% of the saw-timber growth, but much of this, as indicated in the chart on the opposite page, is in unmerchantable stands.

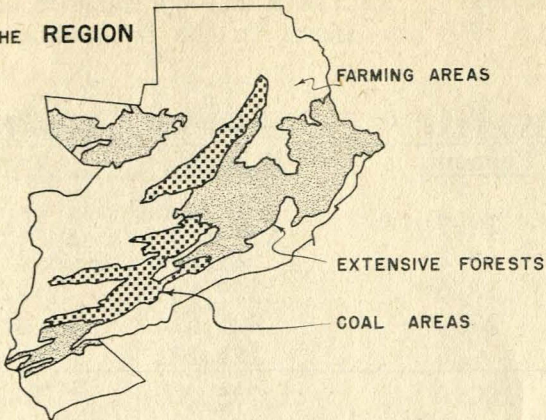
In order to have a sound basis for effective future planning, the Anthracite Forest Region has been divided up into three principal areas. The first of these, comprising the coal fields themselves, is dominated by coal company ownership. As a result of general clearcutting and repeated burnings, over 90% of these forests are now unmerchantable. The forests of the farming area, where small-unit ownership dominates, are in much better shape. They comprise less than half the area, but contain about 58% of the saw-timber and cordwood volumes of the region. The third area is made up of extensive forest tracts, principally in the Poconos and in Wyoming, Sullivan, and Dauphin counties. Nearly a third of this is in public ownership, and the rest for the most part in large privately-owned tracts. These forests also are in considerably better shape than those of the coal fields.

The greatest need of the Anthracite Forest Region is the general adoption of sound forestry measures. Most important is to stop the clearcutting of young timber. The mines can be supplied with the lagging, props, and other round products they require from thinnings and partial cuttings. Growing stock can in this way be built up so that eventually two to three times the present cut can be sustained. Other measures that will help include improved protection against fire in the coal fields and in the high country of Monroe county; planting of open areas and abandoned farm land; conversion of scrub oak and aspen lands to good forest; and planting of mine waste banks to prevent the blowing of dust and the silting of streams. Projects should also be set up for flood control, the control of water seepage into mines, and the development of recreation sites and additional game preserves.

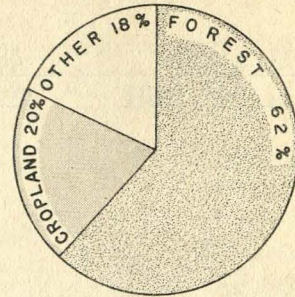
..... IN THE ANTHRACITE REGION

1944

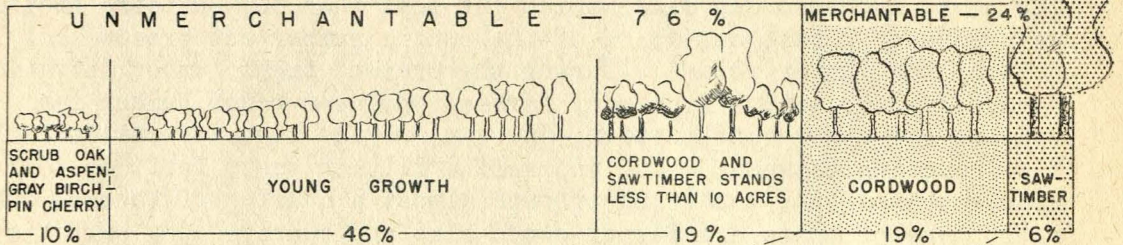
THE REGION



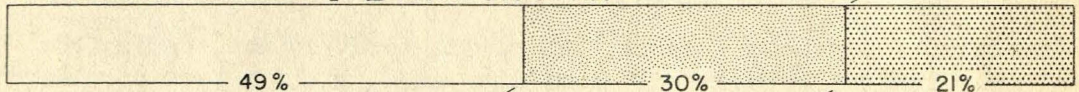
THE GROSS AREA
5 1/4 Million Acres



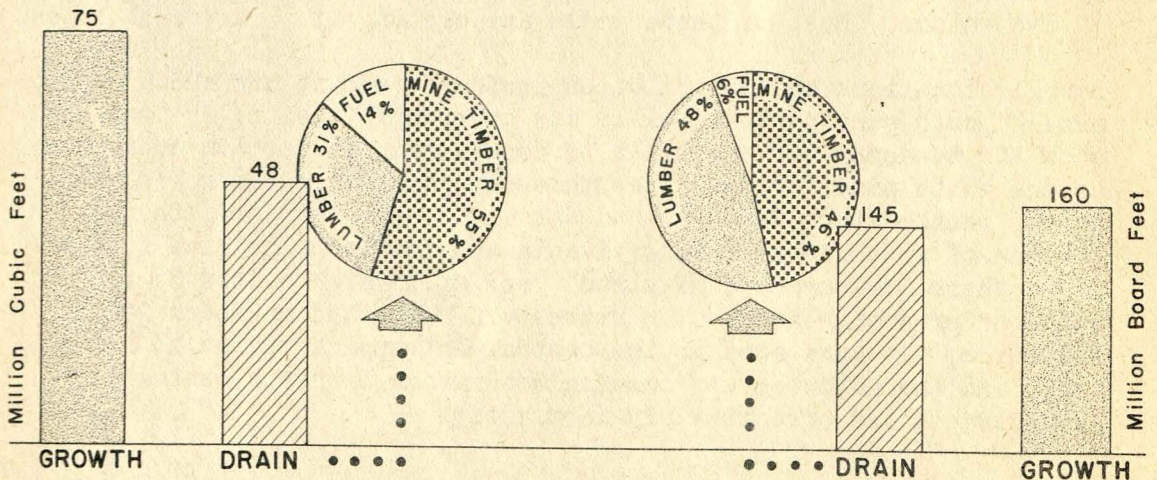
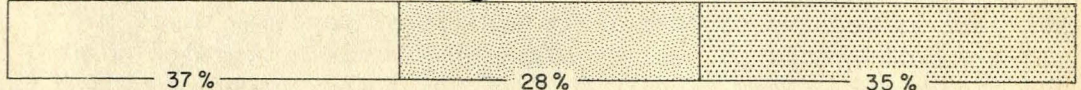
CONDITION OF THE FOREST AREA - 3 1/4 Million Acres



TOTAL VOLUME - 1 1/2 Billion Cubic Feet



BOARD FOOT VOLUME - 2 1/2 Billion Board Feet



SAWMILLS AND LUMBER PRODUCTION

The Northeast has 4,548 active sawmills and 990 idle mills according to the most recent available records*. Active mills by classes and their total lumber production in 1943 are shown in the following table.

Mill class M bd.ft. per year	Active sawmills		Lumber production 1943	
	Number	Percent	M bd.ft.	Percent
1-49	1,350	29.7	24,811	1.4
50-499	2,057	45.2	423,757	23.9
500-999	572	12.6	379,945	21.4
1000-4999	550	12.1	825,414	46.5
5000 up	19	.4	121,281	6.8
Total	4,548	100.0	1,775,208	100.0

The small farmer-owned mills which cut less than 50,000 board feet per year make up almost one-third of the entire number but produce only 1.4% of the lumber volume. During the present tight lumber situation, however, their output aids many farmers who need rough lumber for repairs and minor construction, and can provide logs for custom sawing. Mills cutting between 50,000 and half a million board feet per year make up 45% of the total and produce almost a quarter of the regional cut. Many of these are farmer-owned also and operate on a part time basis. Some could double or triple their output if sufficient labor were available for both farms and sawmills.

The bulk of Northeast lumber, 68% of the total volume, comes from mills which cut between half a million and 5 million feet per year. Many of these could step up production as much as 25% if sufficient labor were available. The class cutting more than 5 million feet per year is made up of both large individual band-saw mills and closely knit groups of smaller circular-saw mills operated under one management. They make up 0.4% of the total number and cut 6.8% of the volume. Most of these mills are cutting at their usual rates.

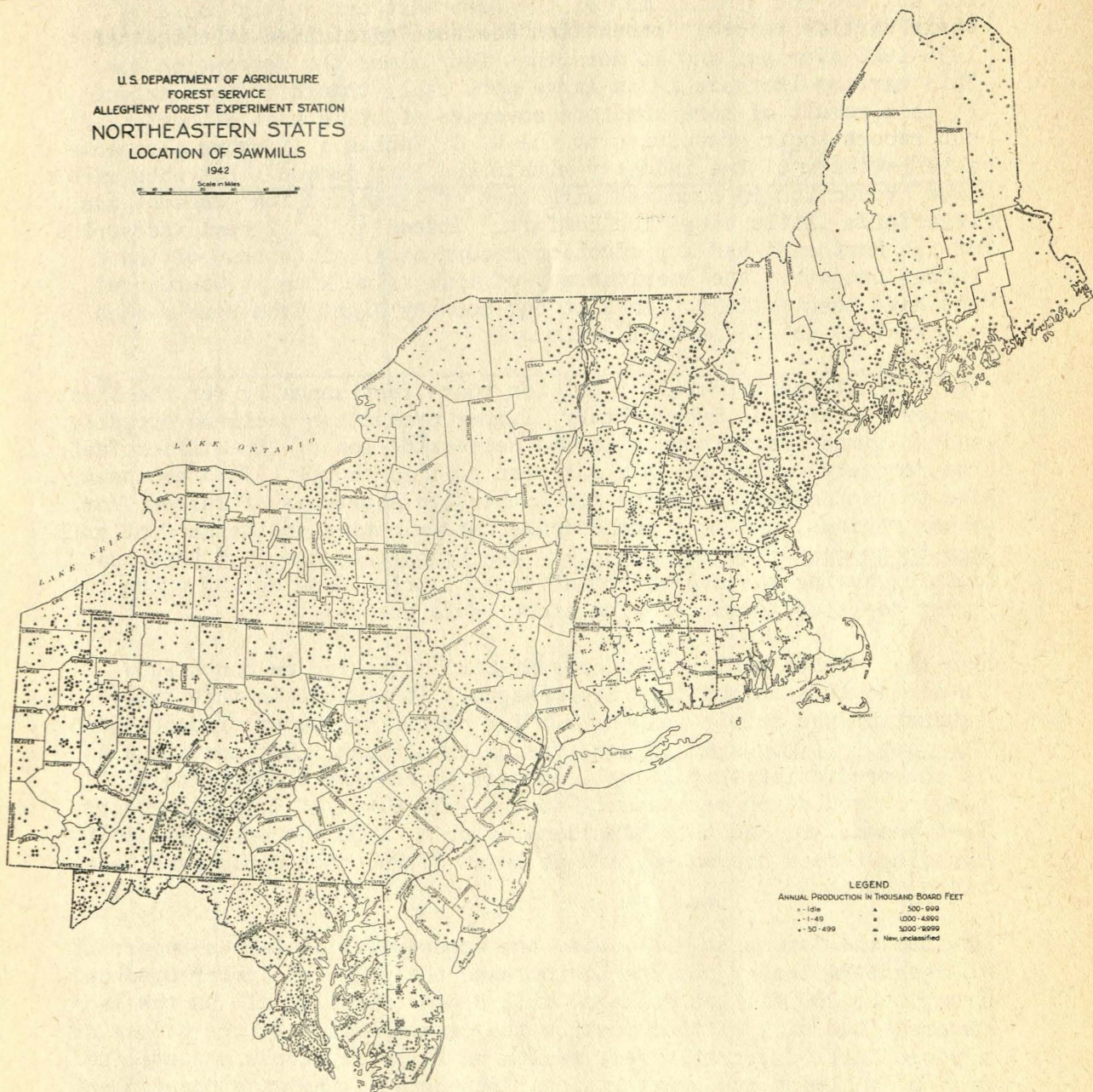
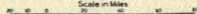
Sawmill locations and distribution in the Northeast are shown on the map. Though many portable mills are constantly moving, the map does show the tendency for the mills to concentrate in certain areas such as the white pine forests of southwestern Maine, southern New Hampshire, southeastern Vermont, and Warren County, New York; the oak forests of south central Pennsylvania and the loblolly pine forests of southern Delaware and Maryland. Few mills are located in the pulpwood producing areas of northwestern Maine and northern New Hampshire, the park area in the central Adirondack region of New York, and the pulpwood and chemicalwood areas in north central Pennsylvania and predominately farm areas.

* New England records were of 1943; Middle Atlantic states, 1942.

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
ALLEGHENY FOREST EXPERIMENT STATION
NORTHEASTERN STATES
LOCATION OF SAWMILLS

1942

Scale in Miles



LEGEND

ANNUAL PRODUCTION IN THOUSAND BOARD FEET

- | | |
|------------|---------------------|
| • - 100 | • 500-999 |
| • - 1-49 | • 1000-4999 |
| • - 50-499 | • 5000-9999 |
| | • New, unclassified |

NORTHEAST SUSTAINS WARTIME LUMBER PRODUCTION OF 1.8 BILLION BOARD FEET

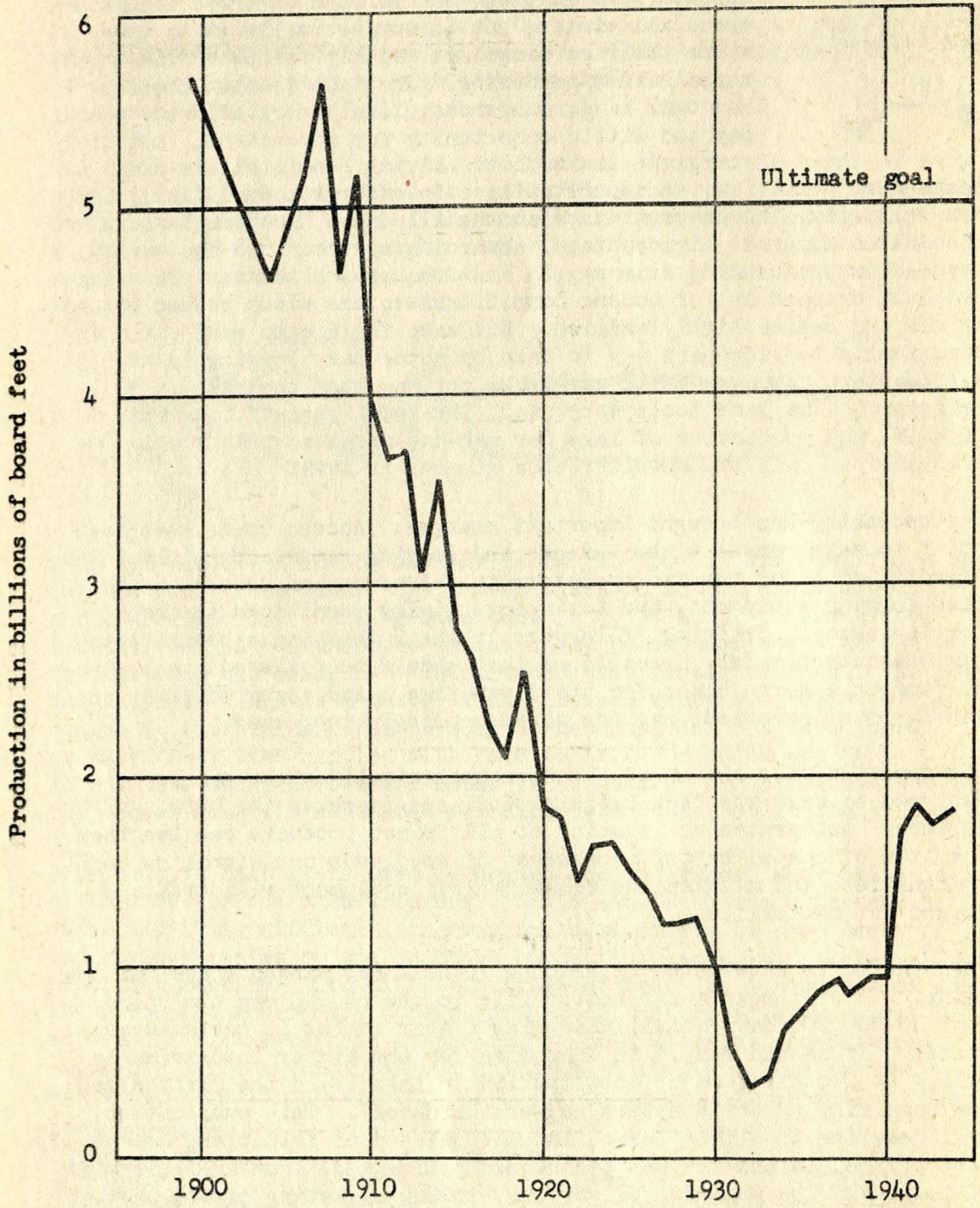
Log cutters and sawmill men of the Northeast can justly boast of their wartime record. Production has been maintained at twice the 1936-1940 average, and at more than four times the depression low. This wartime increase is in large part real, though to some extent it is a result of more complete coverage of mills that hitherto did not report their production to the U. S. Census. It shows a remarkable recovery of the industry within the last decade. But when wartime production is compared with that of three and four decades ago, it affords little cause for comfort. Indeed, if all great industries of the Northeast had a production record parallel to that of the lumber industry, the American way of life as we know it would ere now have been extinct. In fact our country might even have ceased to exist as an independent nation.

Starting at approximately 5 billion board feet annually for the first decade of the twentieth century, lumber production declined steadily and at times precipitously to the depression low of 388 million feet. The recovery during the war has been just as abrupt. This has been due to unprecedented demand for lumber, to shortages of lumber from other regions, and to a commendable determination on the part of mill men to produce. It has also been due in part to the fact that low cutting during the depression afforded a brief time during which the badly depleted forest growing stock could recover.

Can the forests sustain the present cut? Frankly, we don't know. It all depends on how they are managed. It is certain that timber exhaustion was mainly responsible for declining lumber production in the past. It may lead to new lows in the future. But certain also is the prediction that if well managed, Northeast timberlands could support production permanently at the 1900 level of 5 billion board feet annually. Had this been done prior to 1900 the original decline could have been prevented, and at least 60,000 jobs could have been saved thereby.

Whether the Northeast will seize the opportunity that lies before it to recapture these jobs and to increase the value of lumber produced from 50 to 200 million dollars, will depend first of all on the land owners. But back of them must be the determination by the people as a whole that our great forest wealth be fully developed and utilized. Only by applying our great national strength to the wise development and utilization of our vast renewable resources can we expect to preserve American leadership in the future industrial world.

LUMBER PRODUCTION NORTHEASTERN STATES



WILL LOGGING LOSE ITS GLAMOUR?



American loggers have been characterized as hairy chested hard guys who endure spartan lives in the woods all winter, but in spring really go to town, where their earnings are quickly squandered in unrestrained carousing. The fact is that logging has been hard, dangerous, lonely work offering poor pay and little opportunity for advancement. Ambitious young men shunned it. Living conditions in many

camps were primitive, and opportunities to enjoy a normal family life non-existent. Though considered an unskilled job, newcomers found themselves at great disadvantage. Learning was acquired the hard way -- low production, slim wages, and frequent accidents. The weak and dull dropped out or became camp flunkies, the alert picked up the tricks and became highly skilled. But save for a camp radio, and an opportunity to ride part way to camp by motor car, logging in the northeastern camps up until war broke out was much the same as 50 years ago. The same tools were used, the same types of logging layouts, and production of logs per man-day remained practically stationary. Only the outsider sees glamour in this.

War necessity has brought important changes. Access roads have been built to make remote timber stands and logging camps accessible. The scarcity of labor has led operators to introduce and develop mechanized logging equipment, and to improve living conditions in their logging camps. Training of loggers in their jobs and especially in the elementary safety precautions that should be followed has been started on a large scale for the first time. And, as production per man day has increased, pay has correspondingly increased.

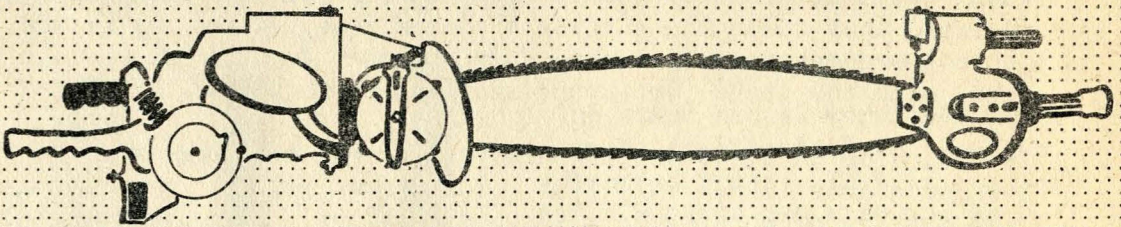
Big opportunities lie ahead. Modern mechanical devices can be designed to ease the back-breaking toil and increase the output of workers. Integrated utilization of all forest products can lengthen the life of camps; better management of woodlands can stabilize small communities; and maintenance of mechanical equipment will create a demand for new skills.

The Station is interested in helping to hold and expand these wartime gains. It will mean a far better life to the 65,000 men who spend some 13,000,000 days annually logging timber in the 11 northeastern states. It should result in economies for the timber industries as well. As its first major contribution in this field the Station is now compiling a "Northeastern Loggers Handbook". This publication will describe in simple terms, and with plenty of illustrations, the best of the old and the new techniques of logging; from the selection of tools and the training of workers, to the marketing of the product. The page opposite is a sample from the handbook.

PORTABLE POWER SAWS

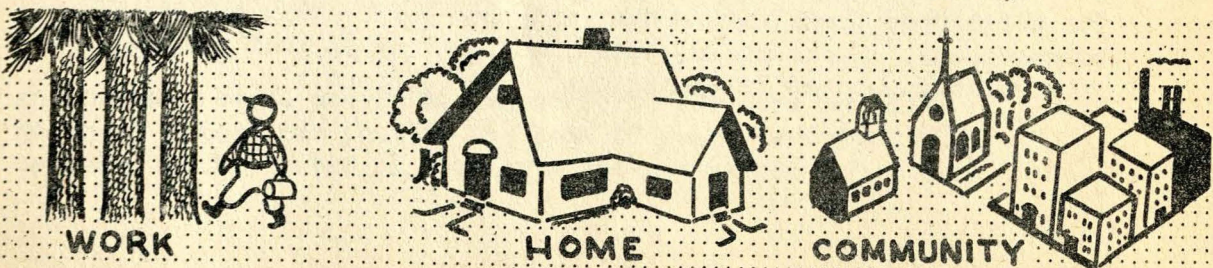
Many types of portable power saws have been developed in the past few years, and others are now in the experimental stage. These vary from very light, electrically driven chain saws to heavy circular saws mounted on tractors. They can be used for felling, bucking, and even swamping. The most popular saw today is the two-man chain saw powered by a two cylinder gasoline motor. Current models weigh from 85 to 105 pounds. Several hundred are in use on northeastern logging jobs. Most of them are being used to buck logs on the landing, but they can be used successfully for felling and bucking in the woods.

The chain saw is a tool for the woodcutter. But in the hands of many woodcutters it has not fared too well. It is a complicated mechanical device, and although some of the models are marvels of simplicity and rugged design for their weight, even the 100-pound, two-man outfit requires careful handling. Some of the general principles in selecting and caring for a chain saw follow.



Size and power: A common mistake is to get too big and powerful a saw for the work to be done. The common sizes of motors available are 6 and 11 horsepower. Cutting bars come in 2, 3, 4, 5, 6, and 7 foot lengths. It is not uncommon to see an 11 horsepower saw with a 4 or 5 foot cutting bar being used in pulpwood that rarely runs over 15 inches in diameter. This is a waste of machine and manpower. Size should be gauged to the ordinary run of work to be done, and the occasional extraordinary tree handled with hand tools. For softwoods up to 4 feet in diameter the 6 horsepower motor is adequate. For hardwoods the 11 horsepower motor is advisable for diameters that require the 3 foot bar.

Sharpening: Most users have purchased the emerywheel sharpening device offered by the saw manufacturers. Chain saw teeth are extremely hard steel and it is difficult for even the best filers to keep track of the various angles on the sequence of cutting teeth and rakers. (One prominent make has five different types of teeth in a sequence of 8). The automatic sharpeners consist of a small motorized emery wheel, adjustable to the correct angles for sharpening each type of tooth and raker, with a track through which the chain is pulled against stops which position each type of tooth to be ground correctly. These



THINNING FOR CHEMICALWOOD PAYS

Northern hardwoods attain optimum development on the Allegheny Plateau of Pennsylvania and New York. Here maple produces those high quality logs required for special turnings such as shoe lasts and bowling pins; cherry, lumber for type backing and furniture; ash, handle stock; and beech and hemlock, general utility lumber. But during the past 30 years the demand for hardwood pulp, mine props, and chemicalwood in this area has caused many stands of vigorous young timber to be sacrificed before attaining sawlog size. No one wants to see these important industries deprived of ample wood supplies. Current results from one of our thinning experiments indicate that selection cutting of these young stands may be the method needed to provide pulp, chemicalwood, or mine props while developing the stand for future saw-timber production.

As indicated on the opposite page, the growth in these selectively thinned stands is not only fast but of good quality. Future cuts will consist of more trees with clear sawlogs. Pulp and chemicalwood can come from thinnings in younger stands needing just such treatment and from tops of sawlog stands. In this particular sample the thinned stand now actually contains over half its volume in trees over 10 inches in diameter and is well on its way to becoming a valuable saw-timber stand.

Probably 10 cords of chemicalwood every 10 years could be removed per acre and still build up the growing stock until the first saw-timber cut is made. Thereafter cuts of about 5,000 feet board measure every 10 years plus cordage in tops and thinnings could be made. In making such thinnings in northern hardwoods, remember:

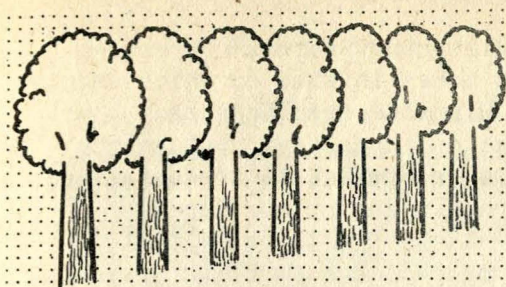
Trees with dominant crowns do not need release to grow well.

Yellow birch may decrease growth rate and begin to die back in the crown if severely exposed to sun and wind.

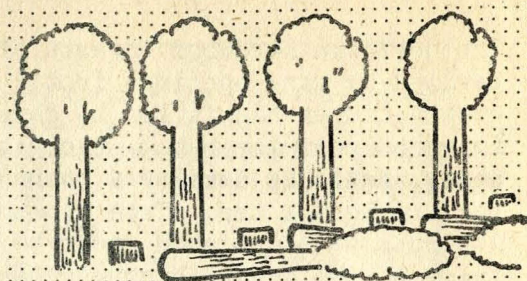
Those large black cherries are about the same age as the other smaller trees. The smaller cherries must be exposed with caution and not suddenly thrown into full light or they respond poorly.

The overtopped trees may recover and grow well. They are not all "suppressed". Sugar maple, beech, and hemlock in that class are particularly good at "stepping out" when released.

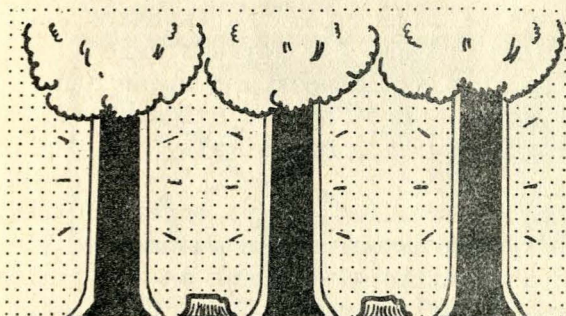
In 1933 a 40-year-old stand of



40 cords per acre
was cut selectively for
pulp and chemicalwood



Taking out 16 cords and leaving
24 cords in healthy,
vigorous trees

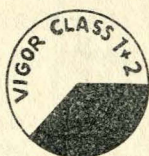


TEN YEARS LATER

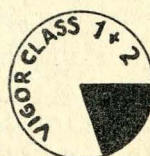
The stand had 42 cords per acre,
due to growth of these vigorous
reserved trees. That is a growth
of 1.8 cords per acre per year.

THINNING increased the proportion of the most vigorous trees

from 63%

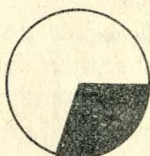


to 80%

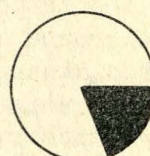


and increased the proportion of trees of best bole form

from 70%



to 81%



BUT

An unthinned stand nearby having 46 cords per acre in 1933
grew only 1 cord per year in the same 10 years, and much of
this was laid on trees of poor form and low vigor.

MAN-CAUSED FROST POCKETS IN PLATEAU FORESTS

The northern hardwood forests of the Allegheny Plateau are characterized by many openings from 3 to 100 acres in size on which second growth timber has failed to develop. Hardwood seedlings that start in such areas may reach a height of two or three feet, but seldom more. Hemlocks develop a bushy appearance similar to those trimmed for ornamental use. Tree growth may remain absent for decades. Attempts to plant such areas to trees have met with only limited success. No accurate survey has been made of the combined area of such openings, but it is estimated to aggregate 40,000 to 60,000 acres.

The Station, realizing that such openings reduced timber yields, undertook to determine the extent to which frost, browsing by deer and rabbits, and other factors were responsible for the absence of tree growth. First of all, it was discovered that existing virgin forest stands had few if any openings of this type. Furthermore, practically all persistent openings in present day forests were covered with large stumps of species such as hemlock and white pine. The openings had developed since logging. Most showed evidence of having been swept by fire, and of browsing by game animals.

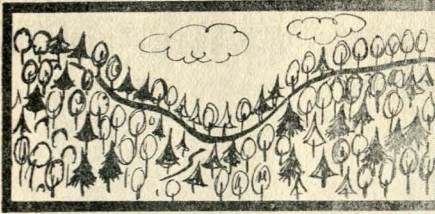
One frost pocket opening was chosen for detailed study, together with three nearby areas representing old growth sugar maple and beech, 35-year-old second growth forest, and an artificial opening on the plateau top. The frost pocket had the highest daily temperatures, the lowest night temperatures, and the shortest growing season, with a prevalence of heavy frosts in late spring that killed back shoot growth. Even the months of July and August were not free from frosts. Fences to exclude deer, and both deer and rabbits, greatly increased the number and height of seedlings on three of the areas but had little effect in the frost pocket. It was concluded therefore that the chief cause of the persistence of the openings is unseasonable frosts.

The explanation is suggested on the opposite page. Frost pockets tend to develop in the small stream valleys. Air drainage is impeded by any narrowing of the small valley or by other air barriers that prevent free airflow near the ground. Consequently, cooling of the ground surface and low vegetation by earth radiation to the clear, calm night sky reduces the temperature below freezing. Tree crowns obstruct radiation from the ground and low vegetation and, as a result, the forest on the adjacent plateau remains warmer than the open valley at night. Frost in the open site on the plateau is prevented by the layer of warmed free air which rises from the valley by day and blankets the plateau by night.

Frost pockets can be prevented by substituting selective for clearcutting, provided fire is excluded. Curing well developed frost pockets is more difficult. Frequently, however, a few gnarled and spreading trees have managed to survive. Great care should be taken to preserve these, for under their protective shelter new seedlings can arise and eventually spread throughout the opening.

MAN-CAUSED FROST POCKETS

Virgin forest on hill and valley



No frost beneath forest cover

Heavy cutting for logs and cordwood strips off the cover.



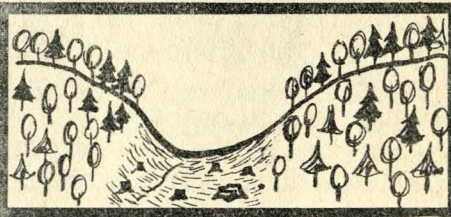
Local climate hotter and dryer by day and colder at night in clearing.

A forest fire sweeps the area



Hot slash fire injures or kills remaining tree growth and bares the soil.

The slopes revegetate but valley remains open.

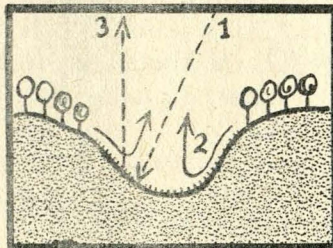


New forest develops on plateau and slopes but fails in valley bottom over 20-40 year periods.

WHY DO SUCH DEPRESSIONS HAVE AN UNFAVORABLE MICROCLIMATE?

1. Solar radiation heats low vegetal cover and soil surface

2. Surface air layer is warmed by conduction from vegetal cover and soil; blankets the valley and when further heated expands and rises to form mass of warmed free air.

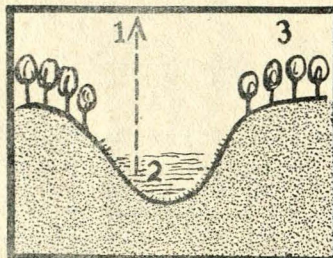


DAY

3. Earth continuously radiates heat into space -- vegetal cover and soil surface act as radiating agents.

1. Terrestrial radiation, unchecked by tree crowns, reduces temperature of vegetal cover and soil surface throughout night.

2. Air cooled by contact with vegetal cover settles in lowest part of valley, builds up in depth and becomes continuously colder until dawn.



NIGHT

3. Layer of warmed free air, and obstruction of terrestrial radiation by tree crowns, keeps air temperature above freezing in late spring and early fall on plateau and upper slopes.

TO REVEGETATE THAT STERILE CUT OR RAW BANK,

where not even the hardest weeds will grow -- USE MULCH

We're talking about really tough sites -- spoil banks from deep and surface mining; borrow pits, cuts, and fills associated with highway, airfield, dam, and large industrial construction; and the most aggravated cases of soil erosion -- barren sites of raw subsoil clay where attempts to establish either herbaceous cover plants or forest trees by ordinary methods are foredoomed to failure. Wartime construction brought immediately to the fore the need for measures that would prevent excessive engine wear caused by dust blowing on new airfields. An expansion of super highway construction and of civilian airports will create comparable problems after the war.

The forester, who frequently is called upon to heal such unsightly scars, must use both cover crops and woody plants to do the most economical job. The first requisite is to stop erosion: water erosion that washes away soil and seed; wind erosion that blows seed out of the ground or abrades tender seedlings at the ground line. Mulch is almost indispensable for this purpose. Fertilizer as a supplement to mulch increases growth and vigor; without mulch, fertilizer is largely wasted on these very severe sites because plants are not able to get started. Loosening the soil before mulching is of no benefit.

In experiments at Beltsville, in a barren cut completely devoid of natural vegetation, fall-sown rye mulched and fertilized with 5-10-5 commercial fertilizer (500 lbs. per acre) yielded at the rate of 3,390 pounds of air-dry straw and grain per acre. Without the fertilizer, the yield was reduced to about one-third that amount; with fertilizer but no mulch, it was reduced to about one-fifth; with neither mulch nor fertilizer, only 62 pounds per acre were produced (see figure).

By using fall-mown weed mulch carrying matured seed, a soil stabilizing cover of miscellaneous weeds such as crabgrass, ragweed, broom-sedge, and partridge pea can be established with no additional seeding. In the Beltsville tests, fall treatment resulted in almost twice as heavy cover the next year as spring treatment. As with rye, fertilizer with mulch increased plant growth, but was even more strikingly ineffective without mulch; soil loosening was of no benefit.

Density of weed cover developed during the first year on plots fall-treated with mulch and fertilizer averaged 21%; i.e., about one-fifth as thick growth as the same species might develop under highly favorable conditions on good field or garden soil. Without mulch, all plots regardless of fertilizer, soil loosening, and season of treatment, remained either completely or practically bare. Mulched plots, when grouped according to fertilizer treatment and season, ranged from 8% to 21% average density (figure 2), or within about the same range as may frequently be observed in recently abandoned fields.

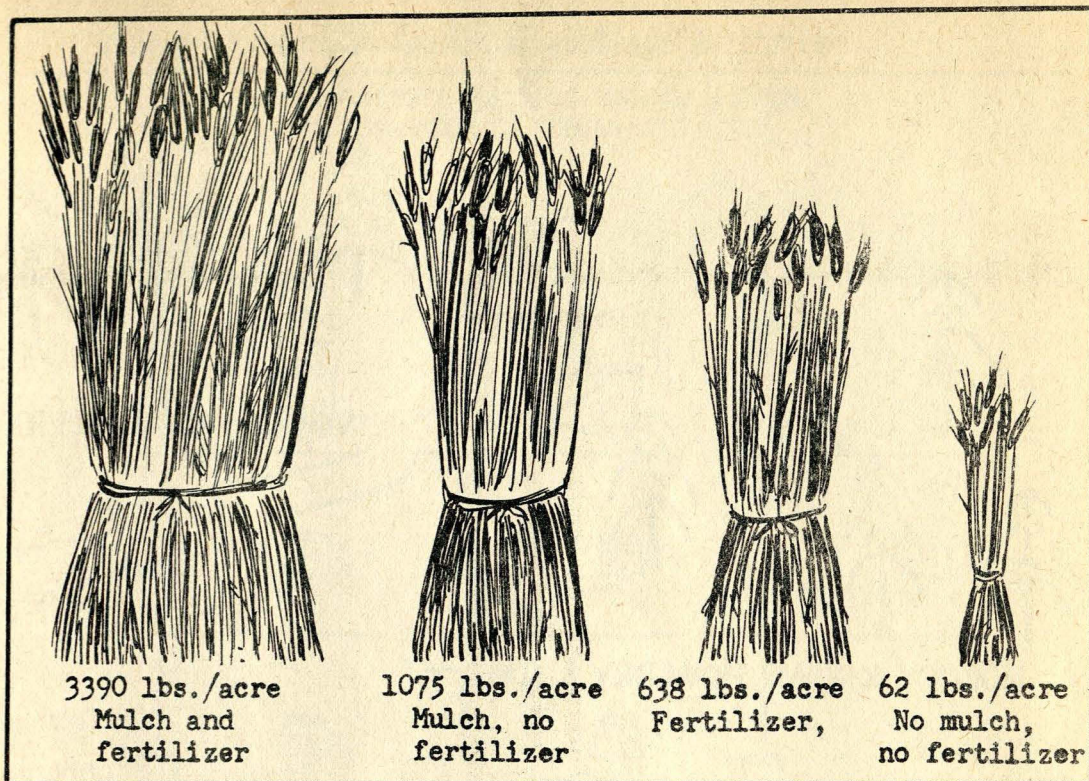


Fig. 1. Effects of mulch and fertilizer on growth of rye on a barren clay site

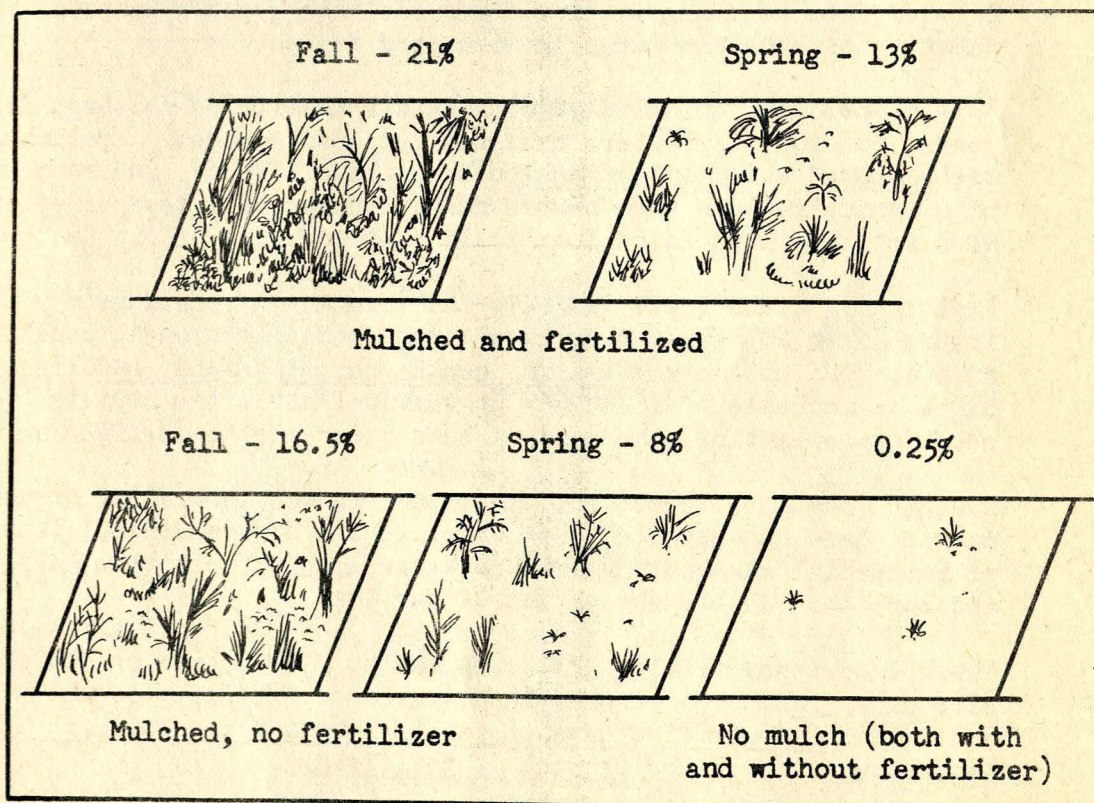
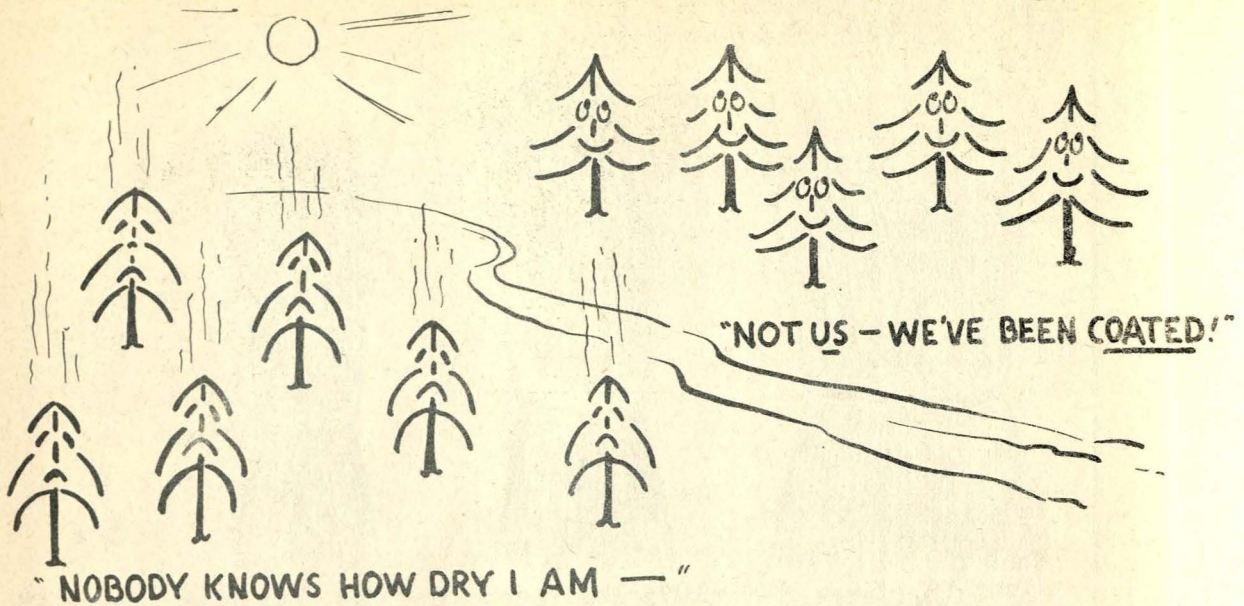


Fig. 2. Effects of mulch, fertilizer, and season of treatment on density of weed cover on barren sites

PROTECTIVE COATINGS ARE CHEAP PLANTING INSURANCE



A dry spell soon after planting can literally "sweat the life" out of evergreen seedlings. Protective coatings greatly increase the capacity of such seedlings to withstand drought.

This is not new. Growers of ornamentals have tried coatings for years, but forest planters have not yet adopted them. Preliminary tests showed several coatings to be of little value, and most in high concentrations have proved harmful. Two have been beneficial when applied in emulsion form to tops by spraying or dipping.

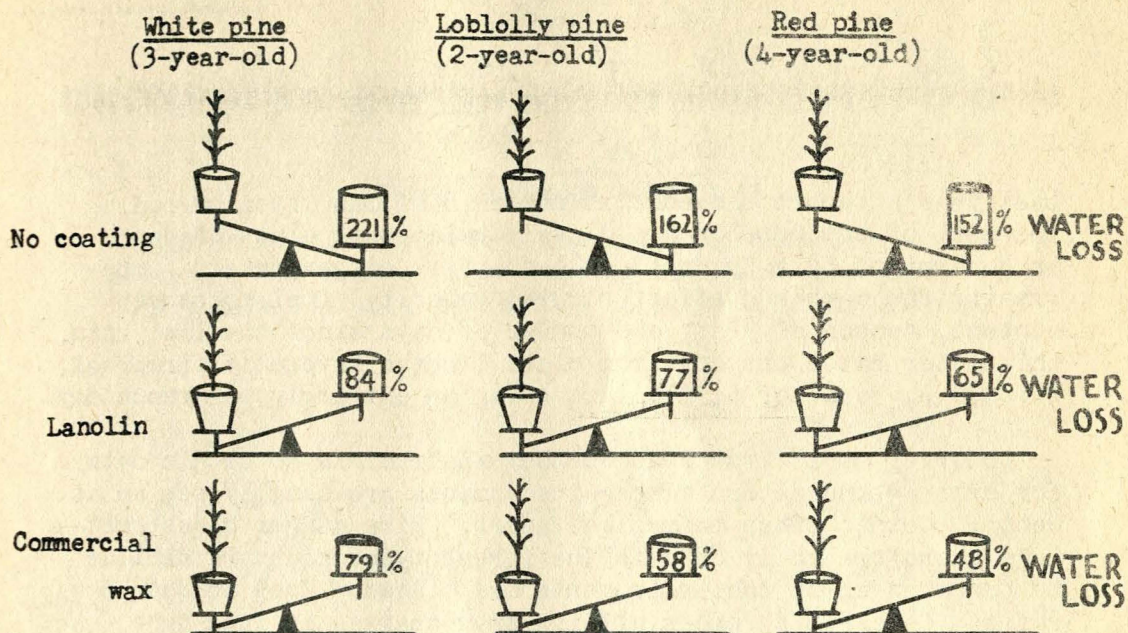
Exploratory field tests indicate that protective coatings may insure 15 to 20% greater survival under moderate drought conditions at a cost of not more than ten cents per thousand seedlings. Since an increase of 15 to 20% in survival may often obviate the need for replanting, the cost of such insurance is negligible.

Recent tests with forest planting stock in the laboratory drought machine have demonstrated that under severe dry conditions lanolin or commercial wax coatings reduce water loss by more than half, and more than double the period of survival.

These laboratory results are presented by pictographs on the opposite page. When you examine them, remember that as a conservative equivalent four or five days of machine drought are equal to about two weeks of sustained drought in the field.

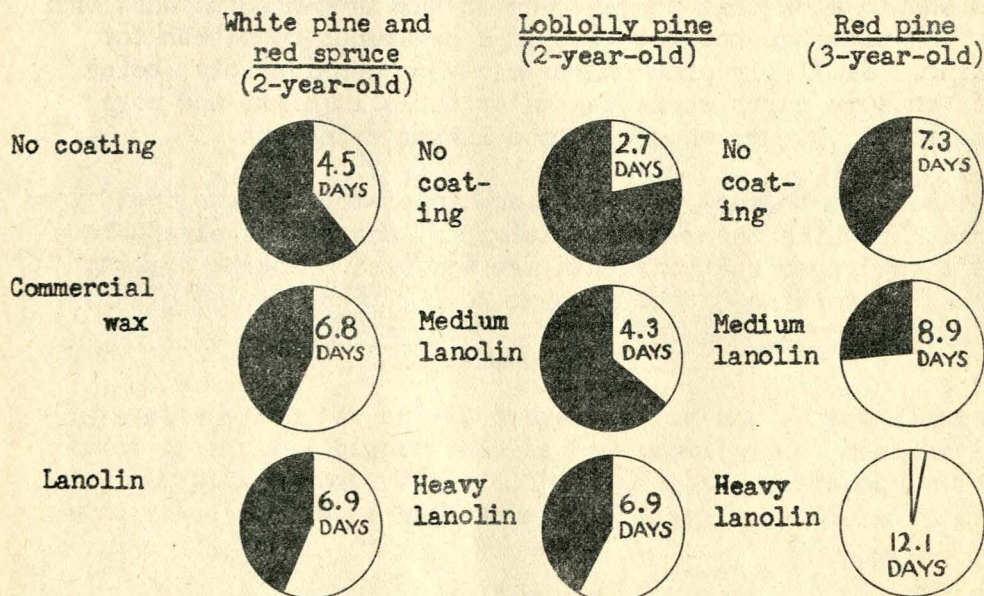
DROUGHT MACHINE TESTS SHOW

I. THAT PROTECTIVE COATINGS GREATLY REDUCE WATER LOSS FROM EVERGREEN SEEDLINGS



Water given off by seedlings sealed in moist sand after 4 days in drought machine expressed as percent of fresh weight of seedlings

II. THAT COATED EVERGREENS LIVE 50 TO 75 PERCENT LONGER



Average survival period in drought machine.
Temperature 97° F. Relative humidity 20-30 percent

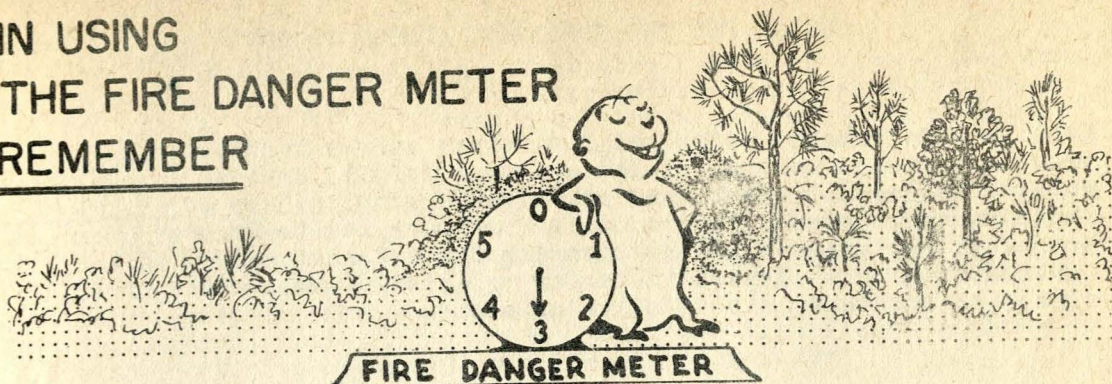
FIRE DANGER VARIES BY FUEL TYPES

Last year's report showed that number of fires, area burned, and cost of suppression are closely related to class of day as determined by a "gadget" called a fire danger meter. Integrating the combined effect of wind velocity, fuel moisture content, season of year, and number of days since the last rain, this meter rates the day from class 1 which is pretty fireproof, through 2, 3, 4, or 5, the last being an extremely hazardous day.

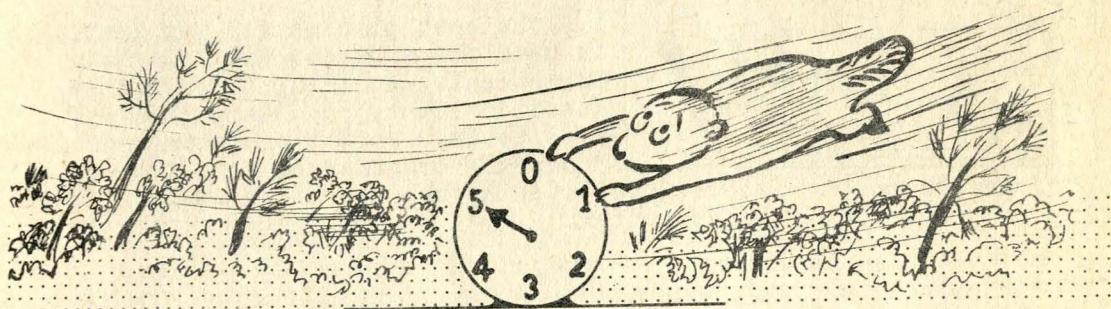
An observer must first read weather instruments to obtain data for setting the meter. These instruments are usually set up at central points often many miles apart. Fire danger class readings therefore apply only to the forest types that are similar to those in which the instruments are placed. They do not reflect local differences arising from changes in fuel type. For example, a fire warden may have part of his district in oak-pine woods, a part in pine-scrub oak, and another part in open grassland or pine swamps. The reading in the oak-pine stand might indicate a class 3 day -- dry enough so that fires, but not holocausts, can be expected. Yet the pine-scrub oak area nearby might be class 4 or 5, as shown in the pictures opposite. Wardens should know that the pine-scrub oak is dangerous when ordinary oak-pine has not yet reached a hazardous condition for burning. Similarly pine swamps may vary considerably, being safer on some parts where the water table is high, and more dangerous in others where surface litter dries out.

The answer is to know the relationship of the various fuel types to that in which the danger station is located, or else have many more danger stations than are now used. The Experiment Station is working on the problem.

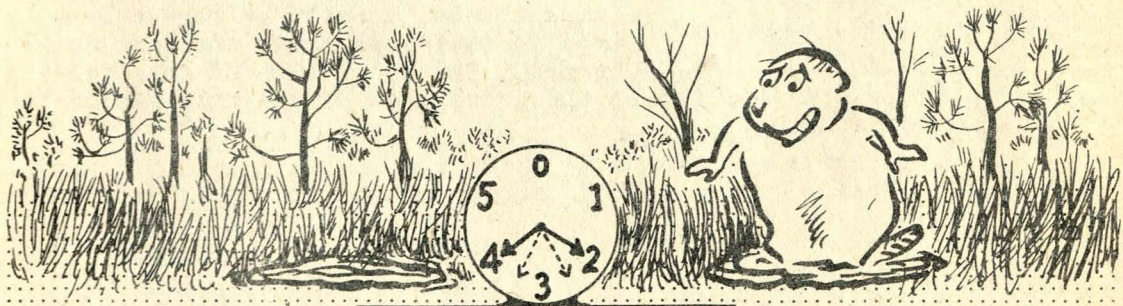
IN USING THE FIRE DANGER METER REMEMBER



In oak-pine stands (above), not recently clearcut, or burned severely, the danger class reading will not vary much. If it's 3 here, it will be about 3 in other similar stands.



BUT In pine-scrub oak areas, the fuel dries out faster and wind velocity effective in increasing spread of fires may be 4 times greater than that under oak-pine stands. Actual fire danger may be one or two classes higher in pine-scrub oak than a meter in oak-pine stands would indicate.

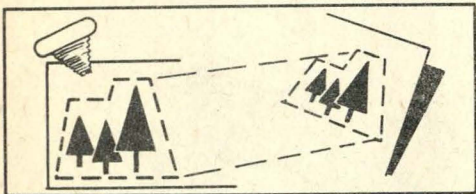


In a pine swamp the actual danger may be one or two classes lower or a class higher than is indicated by one reading in the oak-pine stand. Often a pine swamp has twice the effective wind velocity, but a high water table may keep the litter moist.

SO A danger meter reading in an average oak-pine forest stand doesn't necessarily indicate the danger in other types. Know your district and the relationship of danger in one kind of growth to that in another kind of growth.

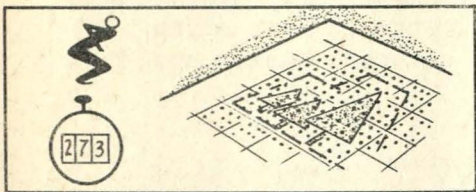
DESIGN FOR THE NORTHEAST FOREST SURVEY

Last year we briefly described the forest survey techniques and procedures which were developed and successfully applied in the Anthracite Region. Continued experiments with the use of aerial photographs supported by ground surveys have led to further progress. At present we are planning for a forest survey of the Northeast which will yield data for relatively small units of area. It consists of the following steps.



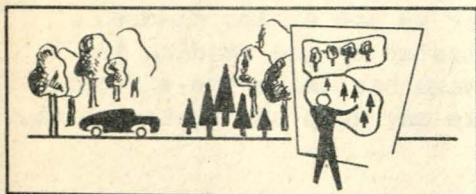
1. The best planimetric map available is used for a base. State highway departments usually publish fairly detailed county road maps that are acceptable. Forest areas and secondary roads are transferred from the aerial

photographs to the base highway map through use of an image reflecting projector or a stereoplotter.



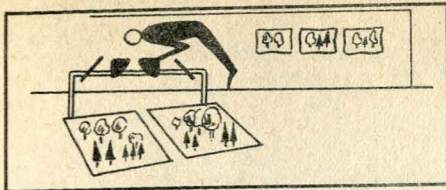
2. Acreages of forest land are estimated with the use of transparent dot grids. These grids are placed on aerial photo index sheets, mosaics or forest area maps so that they cover the unit concerned. The proportion of dots falling

on forest areas when applied to the gross area of the unit yields the acreage of forest land.



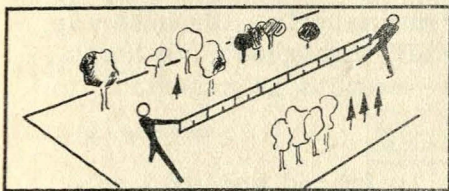
3. Forest types are delineated on the forest area maps during field reconnaissance, by automobile, and on foot. These are later refined through detailed analysis of aerial photographs under the stereoscope. Some forest types are

readily distinguished on aerial photos. Winter exposed photographs and infra-red prints of summer foliage have proved particularly useful in separating conifers from hardwoods.



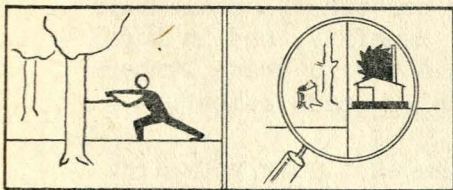
4. Each forest type is also broken down into appropriate condition classifications by careful stereoscopic analysis of the photographs. Several volume-per-acre classes can be recognized. Average heights of stands are determined from

measurements on the photographs of dominant trees, and average numbers of trees per acre are counted, using one-fifth acre templet overlays. By applying these heights and tree counts to average total height volume tables (prepared for each forest type) the approximate volume per acre is computed. This is merely an indicative figure used in determining the condition class into which each tract falls.



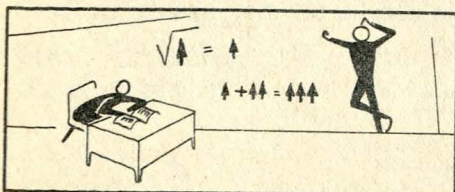
5. The several forest type and condition classes are then sampled by ground cruise to obtain detailed volume-per-acre estimates by species and diameter classes, a sample of appropriate statistical adequacy being taken in each case. Experience has

shown that the prior delineation of relatively homogeneous forest type-condition classes by photo analysis permits substantial economies in the sampling process. Total volume is of course the sum of the products of forest type-condition classes areas and corresponding volume per unit of area.



6. Growth is estimated through predictions of future stands based on increment borings taken from trees of the various diameters and species in each forest type-condition class. A separate study determines the extent of forest depletion caused by

cutting and the destructive agencies of fire, wind, insects, and disease.



7. Resulting reports are of two classes: (a) statistical compilations of forest volumes, growth, and depletion, and (b) analytical reports, showing what may be expected of the forests in the future, and what management policies and methods

should be employed to insure greatest benefit.

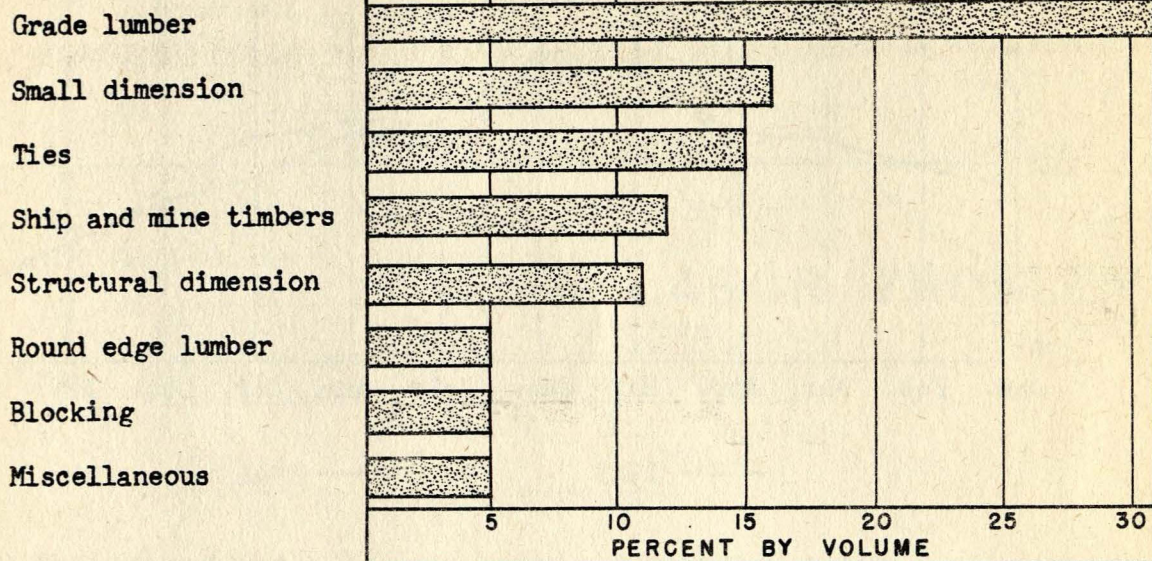
HARDWOOD LUMBER PRODUCTS AND PRICES AT SMALL SAWMILLS

Small sawmills, those cutting less than 2 million board feet per year, produce more than 60% of the total lumber and 92% of the hardwood lumber cut in the Northeast. They turn out eight special types of products from hardwood logs. Grade lumber (lumber that could be graded) makes up 31% of the total, with small and structural dimension, ties, mine and ship timbers, round edge lumber, industrial blocking, and miscellaneous material making up the remainder as shown in the bar diagrams opposite. These products are sawed by some 4,400 small mills. They make up the raw material for hundreds of both large and small wood-using industries throughout the Northeast. The continued availability of these products is essential to the lives of these industries.

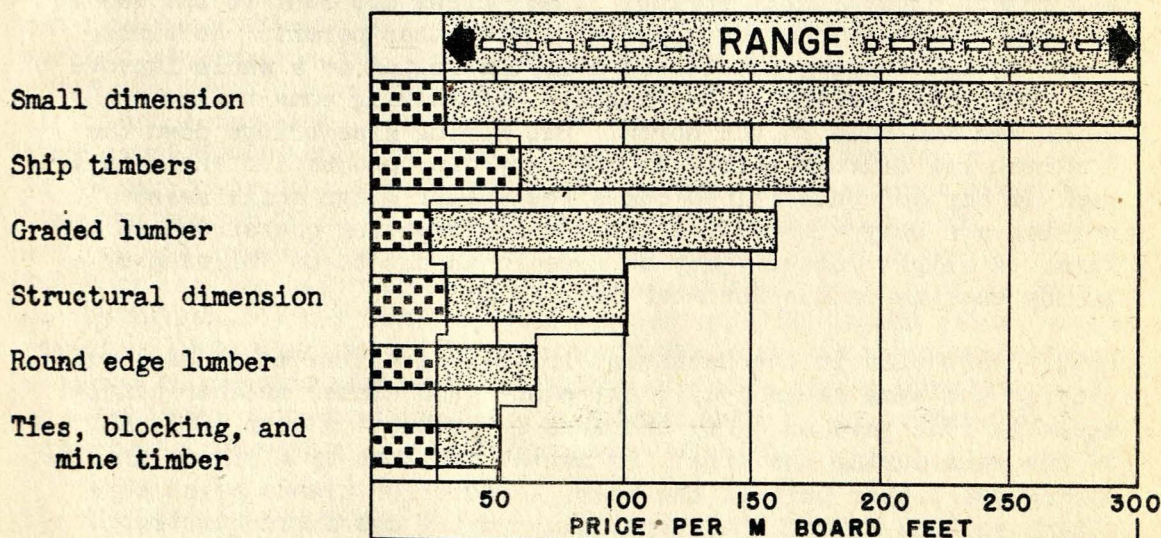
Only one-half of the grade lumber is actually graded and sold on standard hardwood lumber grades, the remainder being sold log run or mill run. This practice is probably influenced by the fact that 75% of the mills do not have approved lumber inspectors or graders. Of those selling on grade, about half do their own grading, the other half using buyers inspection and grade. The large percentage of mills depending upon the buyers grade is typical of the Northeast because small mills generally cannot afford to employ lumber inspectors. This practice has tended to encourage degrading of lumber during periods when plenty was available and upgrading during times of shortages, thereby complicating pricing practices. Small mill operators would reap substantial financial benefits, and in turn serve the market better, if they all learned how to grade lumber and how to saw to obtain maximum yield of high grade lumber.

Prices received by small sawmills during the past year vary from \$23 per thousand board feet for birch dunnage to \$300 for ash snowshoe stock. The average price received for all sawed hardwood material is \$55 per thousand, grade lumber and dimension stock averages \$58, ties \$43, and industrial blocking, \$39. The variations in price are due not only to type of product but to species, grade, markets, location, degree of seasoning and finishing, dimension of the product, sawing practices, and other things. All of these create a complex pricing problem. Price ranges by products are shown in the lower bar chart.

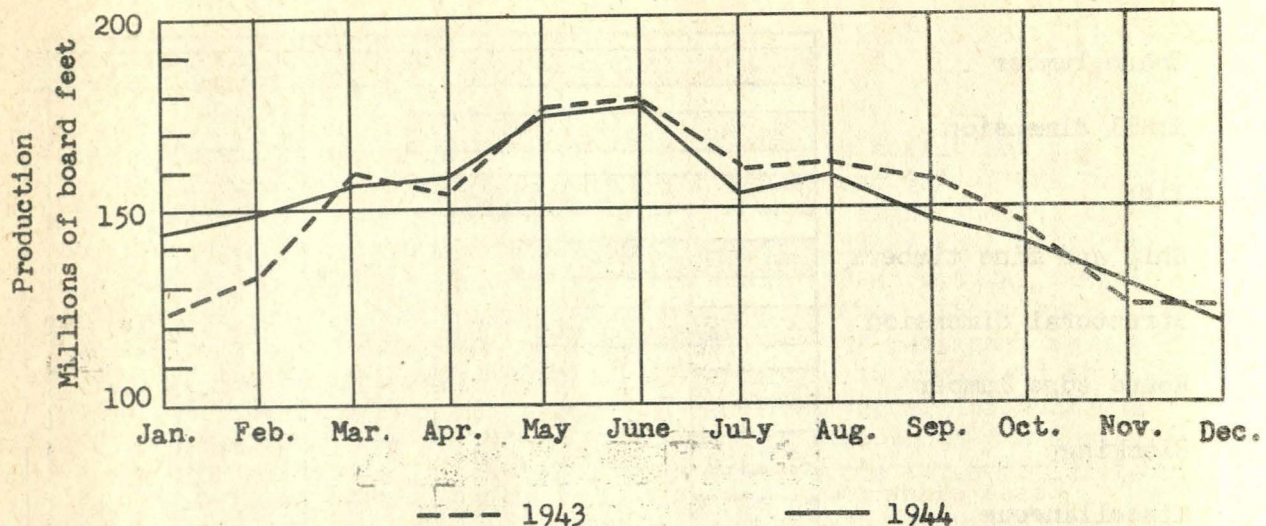
HARDWOOD LUMBER PRODUCTS OF SMALL SAWMILLS IN THE NORTHEAST



HARDWOOD PRICE RANGES BY PRODUCTS



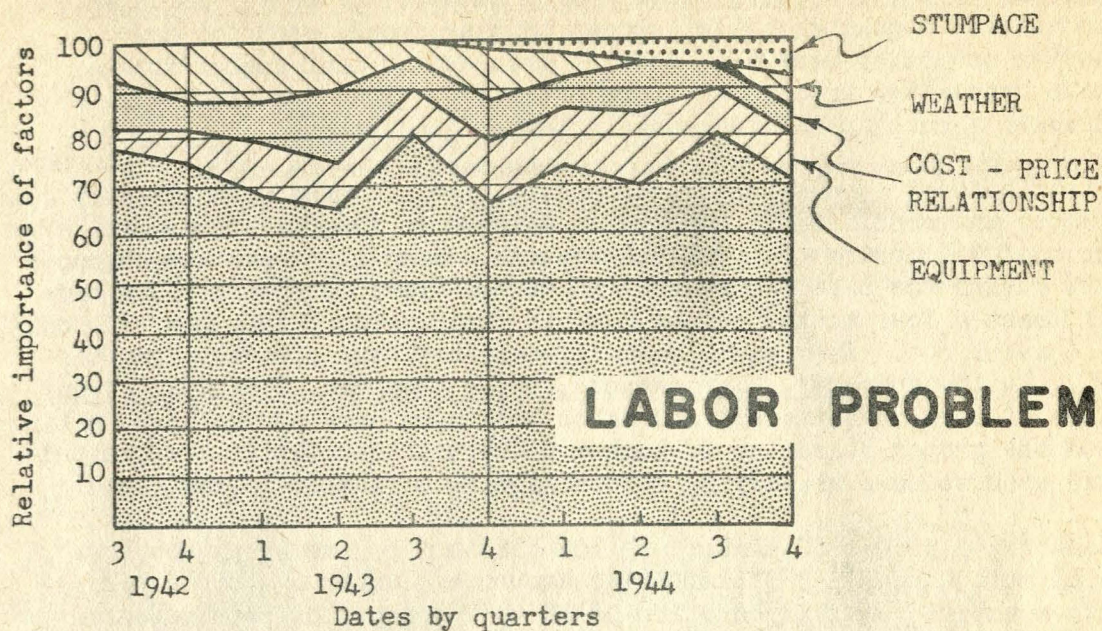
MONTHLY TRENDS IN NORTHEAST LUMBER PRODUCTION



Monthly lumber production in the Northeast followed surprisingly uniform trends for the years 1943 and 1944. The low point occurs in early winter after log supplies from the previous winter are exhausted and before new ones accumulate. At this time also occur hunting seasons, holidays, and the first illnesses of winter. Bad weather also interferes. Log ponds freeze, and snow and insecurely frozen ground hamper transportation. Many mills close at this time and remain closed until spring. Their crews are sent to the woods to log; others saw as log supplies and weather permit. As winter wears along, logging conditions over the region as a whole improve and production gradually increases. With spring come rains in the south and mud time in the north. But spring also brings down the northern log drives. After a temporary dip, production rises to its peak in May and June. Then comes the summer slump while seasonal workers are busy with haying and other harvesting operations on the farm. A slight recovery may be made in August to be followed by a steady decline to the December low.

Total production in the Northeast in 1944 is estimated to be practically the same as in 1943. Extremely good winter weather conditions in 1944 gave an early increase in production over 1943. All of the gain during the first few months was lost by a steady decline during the latter part of the year. Production trends point to a slight decline during 1945 especially during the first quarter.

FACTORS IMPEDING INCREASED LUMBER PRODUCTION



The Northeast has maintained lumber production at a high level despite many wartime difficulties. These began to cause serious concern within a few months after the United States entered the war. Accordingly, upon request by the War Production Board, the Station began with the third quarter of the year 1942 to make periodic estimates of factors influencing lumber production. These estimates were based on interviews with loggers, sawmill operators, and others.

From the very beginning labor shortages have been the outstanding obstacle. The drain of woods workers and mill hands to war industries and the military forces has not been completely offset. Mill men have been able to keep up production only by working harder, working longer each day, training new workers better, using new power equipment, improving sawmilling practice, and applying more efficient management. They have accepted labor shortage as inevitable and concentrated efforts on measures to minimize its effect. As the war goes into the fourth year, equipment maintenance becomes more and more difficult. Trucks and tractors are wearing out, tires are getting thinner, replacements are meager and slow in coming. Still by pooling efforts, releasing unneeded equipment to others, and by makeshifts the industry has carried on. Costs and price relations have been out of line from time to time but these have been met by readjustments by the Office of Price Administration, by acceptance of narrow operating margins, and by such additional adjustments as each operator could apply himself.

The Timber Production War Project of the Forest Service and the Lumber Division of the War Production Board have helped immensely in lining up equipment, supplies, special technicians, in training sawyers and workers, and in locating new sources of labor.

WAR DEPLETES LUMBER STOCKS

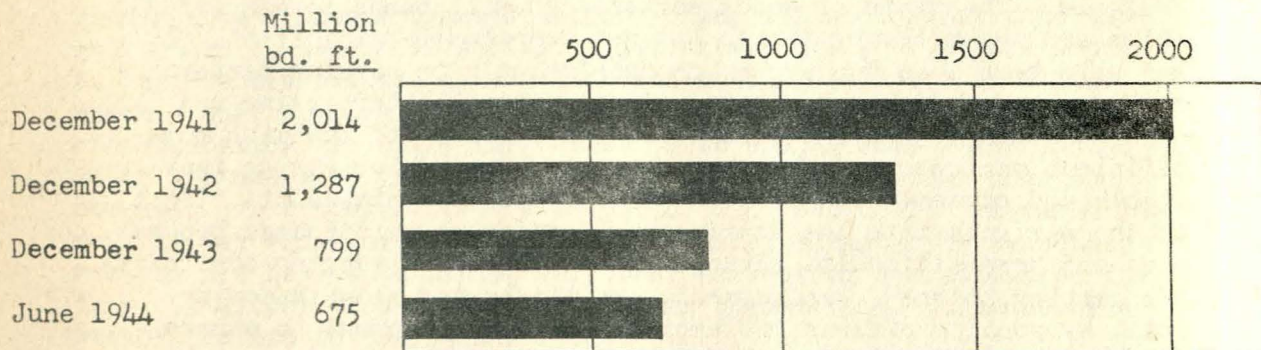
For the past three years construction lumber, box boards and dunnage, industrial blocking, pallet stock, bending stock, wood for truck bodies and other uses have been in such demand that lumber stocks have been eaten into to an alarming extent. This has occurred despite a substantial increase in lumber production.

Distributors' stocks in the Northeast, that are made up of locally cut lumber and considerable quantities shipped in from other regions, have dropped 66% during the past three years. Sawmill stocks have dropped 58% during the past two years. In normal times northeast mills have at least a four months cut on hand in their yards. They now have only a 6 weeks cut. Many small sawmill operators haul directly from the mill to the consumer. War demands, sales pressure, financial advantage of a rapid turnover, and labor shortages work against yard piling and the proper seasoning of lumber. Dry kiln facilities are limited and even so some air-drying before kilning of lumber is desirable.

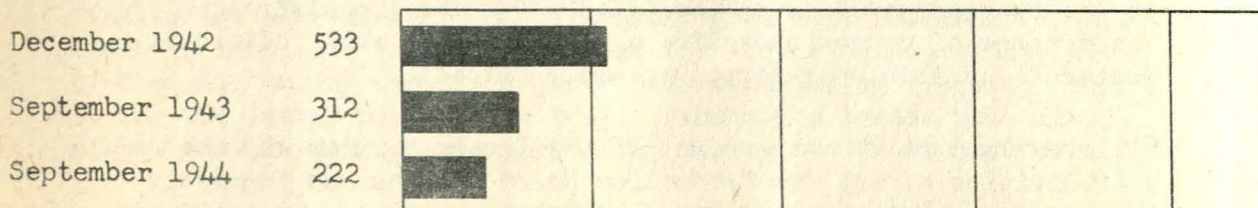
Industrial stocks of lumber are low also but no one knows how low. Limitation order L-335 limits the amount of lumber available for nonessential uses. Production is 10 to 20% short of requirements. This puts additional pressure on the depleted stock piles.

What does this depletion mean? Just this -- extra transportation costs to move green lumber, use of much green lumber where seasoned is needed, and difficulties all along the line in filling orders to the specifications desired. With orders still in excess of output, no relief is in sight.

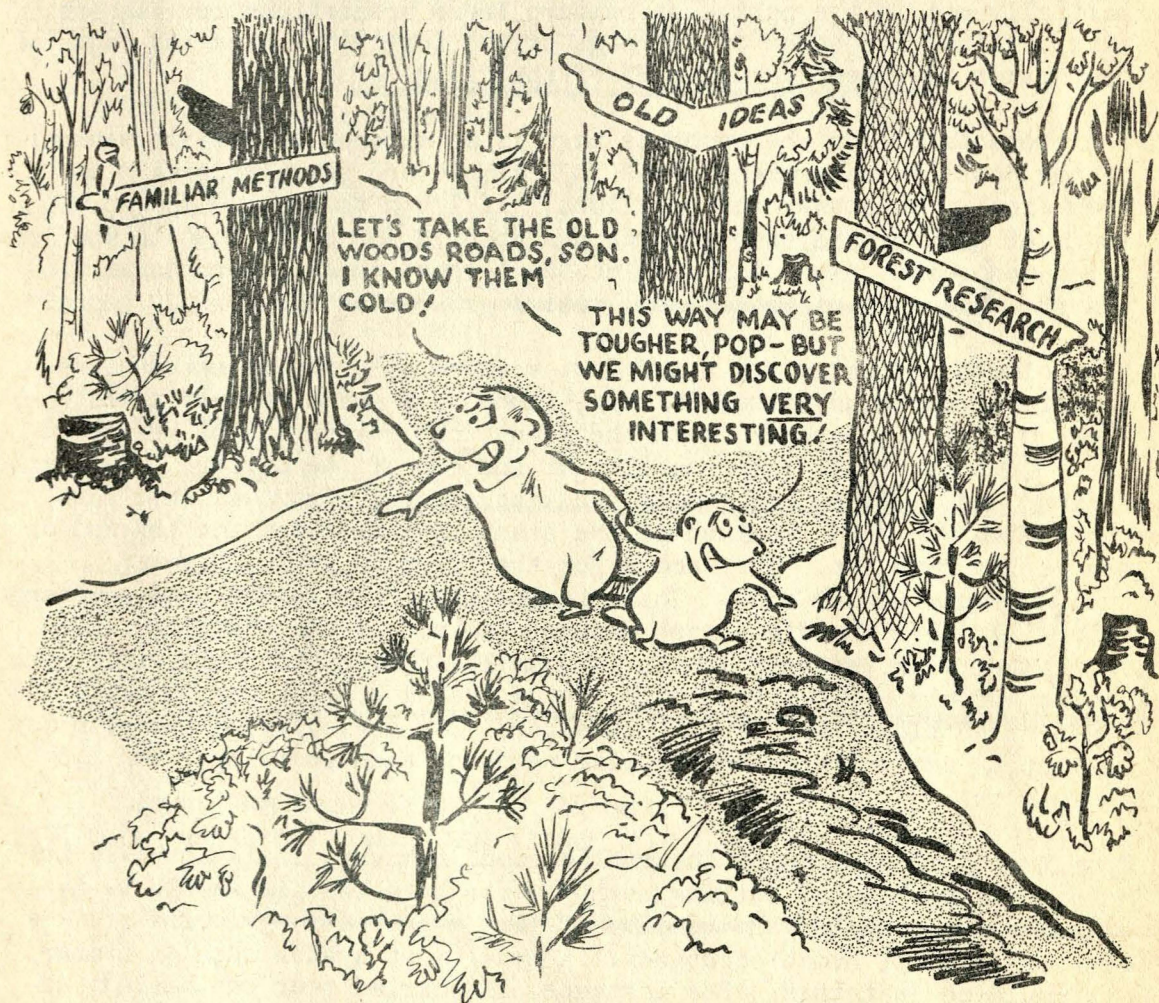
Lumber Distributors' Stocks in the Northeast



Lumber Stocks at the Sawmill



Readers of annual reports have expressed an interest not only in what the Station has completed but also what it is working on. As many forest research projects of necessity require years for completion, preliminary reports on leads developed from time to time are distinctly worth while. Two in the field of Forest Genetics and one in Forest Management follow. These may or may not "pan out". Only additional research can provide the answer.



DOES SELECTIVE CUTTING OF NORTHERN HARDWOODS PAY?

Forest owners frequently ask the Station, "Would it pay me to practice selective cutting?" Frankly, we cannot answer this question satisfactorily -- so much depends upon the skill with which the cutting is done; so much upon the business acumen with which the products are sold. Volume yields depend on soil, species, and stand composition; monetary yields on market conditions and on maintenance and logging costs. And even if future market conditions and costs were known, we have not yet established enough permanent cutting plots, nor carried them for a sufficiently long period to provide an accurate answer as to growth rates and timber yields.

With this warning, we are presenting estimates as to what selective cutting applied to 60-year-old northern hardwoods might mean. These estimates are based on analyses of growth since cutting on a few sample plots of different ages, and on reconstruction of stands that have been partially cut in the past. We believe these predictions are conservative. Values are based on stumpage prices for 1940; taxes and costs of protection have been taken at 8% of the yield.

The presentation on the opposite page is an attempt to compare several of the possible management plans in a simple and straightforward way -- specifically to answer the questions, "If I own today a 60-year-old stand of northern hardwoods which has about 8,800 board feet to the acre, which management plan will give me the largest income over the next 60 years? What part of this income will I get during the next 20 years?"

The volumes indicated are board foot volumes only and do not include any of the cordwood volume in tops, limbs, and small or cull trees. They do include, however, both the amount cut during the 60 years and the volume of timber left standing at the end of the period. The income figures are likewise the sum of the cash received from all cuts plus that which would be received if the standing timber left at the end of the period were cut. The income for the first 20 years, however, includes only actual cash. These income figures have not been compounded. Naturally, more immediate cash can be obtained by clearcutting. From the longer view, however, relatively small and frequent cuts yield more income and higher quality lumber. Even over a 20-year period small and frequent cutting proves itself superior. But obviously no one plan for harvesting can satisfy the peculiar needs of each individual and his pocketbook.

From the point of view of the public good, however, it is possible to advocate a particular cutting method. For here the aim should be to maximize the quantity and quality of timber over a long period of time -- over the span of human occupancy. A management system such as number six would do just this. For instance, if carried over two periods of 60 years, plan six would yield an income of \$740, whereas the clearcut method of plan one would provide only \$260. Very few individuals would be interested in planning so far in advance, but a nation can and must if it is to realize the full potentialities of the forest resource.

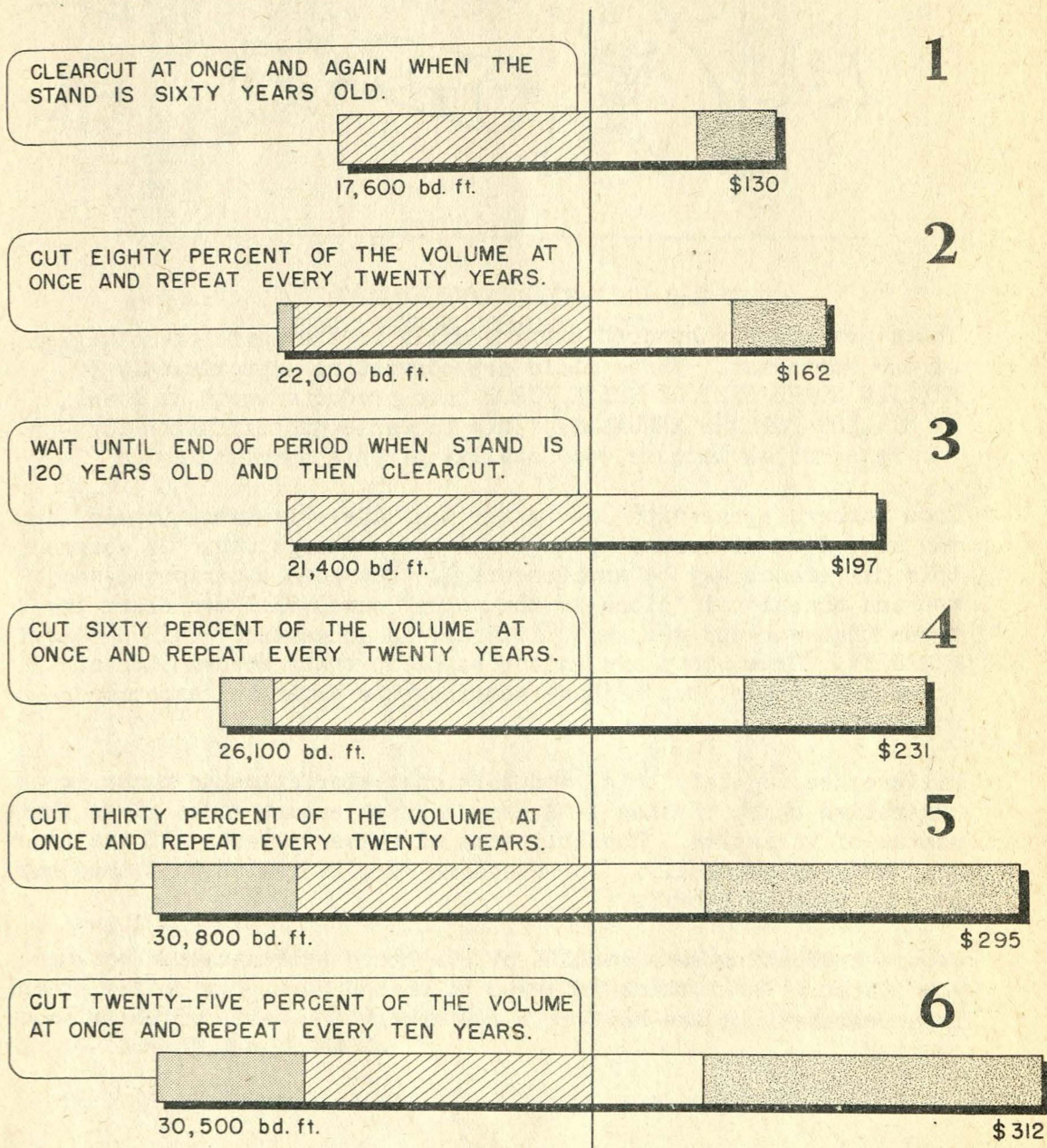
VOLUME AND INCOME

VOLUME
REMAINING

VOLUME
CUT

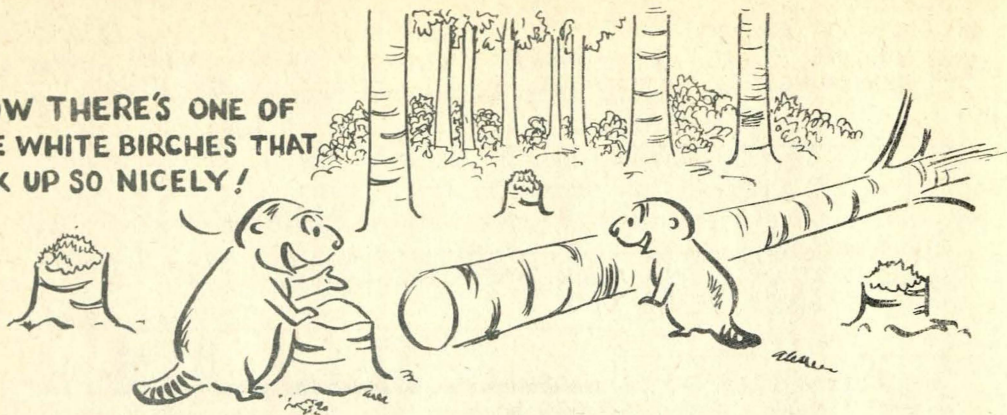
INCOME DURING
FIRST 20 YEARS

TOTAL
INCOME



PER ACRE

NOW THERE'S ONE OF
THOSE WHITE BIRCHES THAT
WORK UP SO NICELY!



There are about a hundred turning mills in the white birch region of the Northeast. These mills are converting approximately 50 MILLION BOARD FEET OF WHITE BIRCH into products worth at least $6\frac{1}{2}$ MILLION DOLLARS ANNUALLY. This is ample justification for our research to improve wood quality of this species.

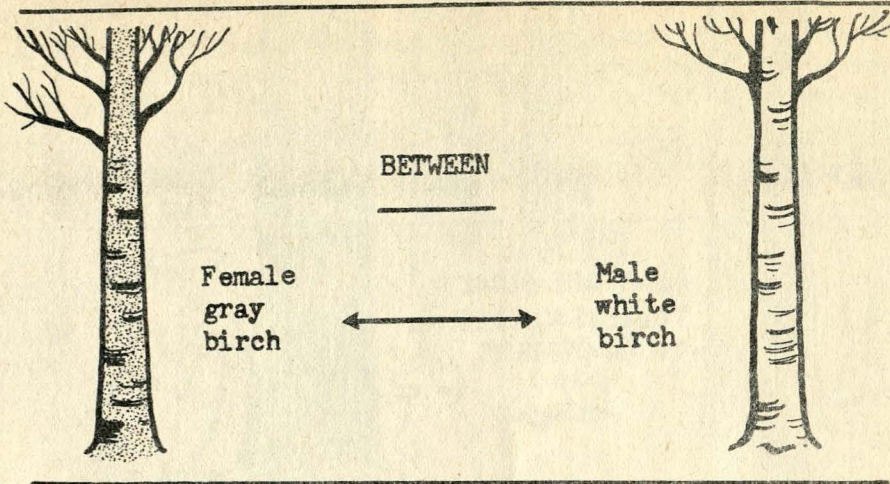
Wood turners agree with Joe Beaver that there is variation in the way wood from different white birch trees "works up". Of course this difference may be environmental. But some experienced woodsmen and occasional "close-to-the woods" dowel-mill men claim the trees that work up well are different in appearance; THIS SUGGESTS HEREDITY. True, they are rather vague in their description of these best trees, but we have considerable faith in "experience-hunches".

Differences in leaf, twig, and bark characteristics do occur among our native white birches -- a few distinct enough to be given the status of varieties. Possibly some of these variants ARE the types that work up so nicely. Our breeding work indicates that they may even be natural hybrids.*

We are presenting some results of our birch hybridization to keep you posted. The hybrids referred to on the next page differ greatly in appearance but are not yet large enough for tests of their wood quality.

* Such natural hybrids could be perpetuated and multiplied to a limited extent as apomicts; i.e., by seeds which have not required fertilization.

FROM OUR HYBRIDIZATION



WE NOW HAVE ABOUT 1,000 THREE-YEAR-OLD TREES
READY FOR PLANTATION TEST



Only 2 or 3 of these seedlings resemble the female parent in appearance -- all the others are unquestionably "chips off the old male block". But they are extremely variable in appearance; they practically cover the gamut of variation to be found among our native white birch.

SOME OF THEM MAY BE THE ELITE BIRCHES THAT "WORK UP SO NICELY".

As in the case of sugar maple we could multiply such an elite hybrid without loss or modification of its inherent qualities by propagation from cuttings.

SWEETER TREES FOR THE SUGAR BUSH



IT'S A FACT!

Some sugar maples ARE sweeter than others. The sap from one tree on our Hopkins Experimental Forest averaged 8% sugar during the 1941 season. Others nearby yielded 3% sap, and that from the average sugar bush carries about 2.2% sugar.

Joe Beaver couldn't know the reason -- in fact we have ONLY JUST BEGUN the unraveling of this knotty problem ourselves. Soil and forest care have a large influence, but part of the difference is undoubtedly inherent.

It's the inherently sweet tree we're searching for. When we find it, we can multiply it indefinitely by cuttings without loss of its inherent sweetness.

MAPLE SYRUP PRODUCTION IN THIS NORTHEASTERN REGION PROVIDES FARM FAMILIES WITH A GROSS INCOME OF \$5,000,000 ANNUALLY.

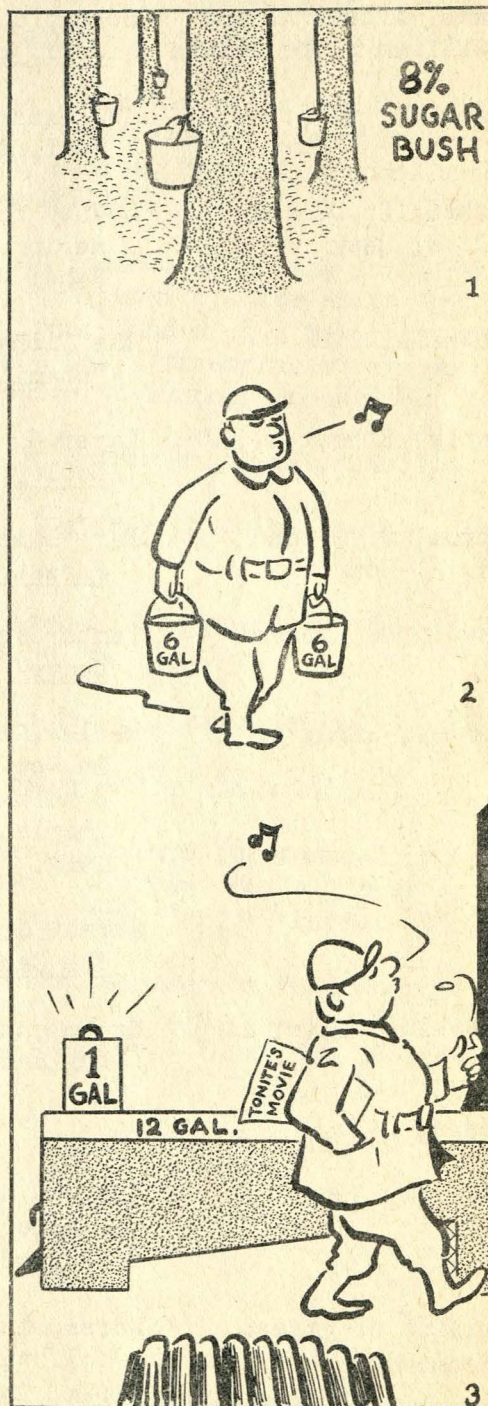
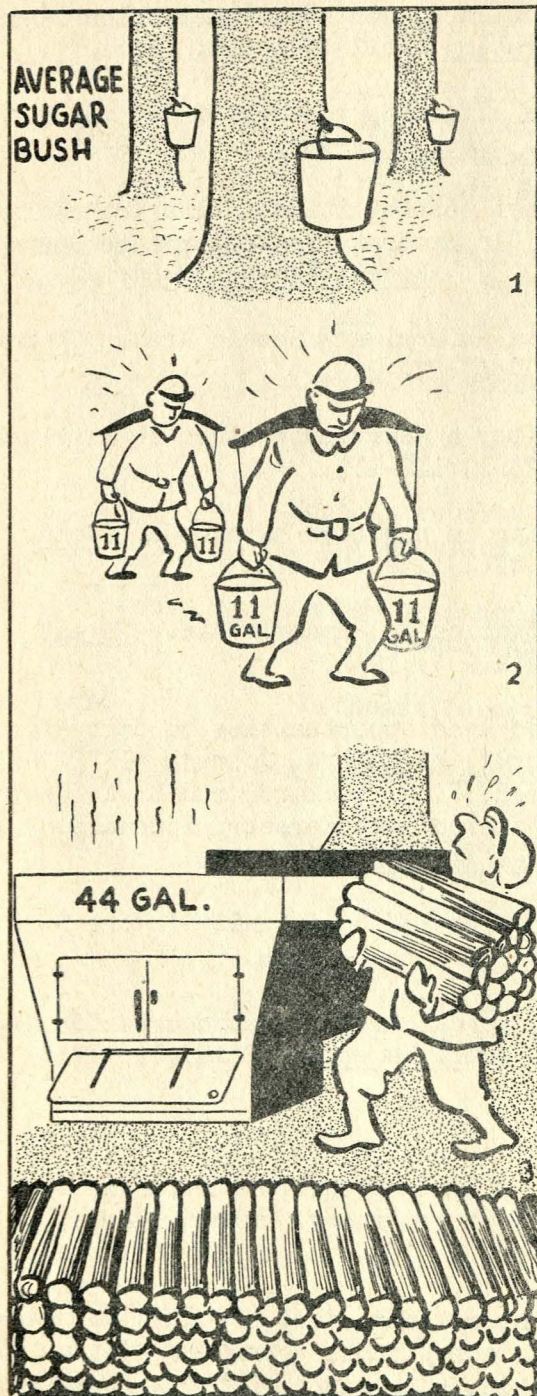
It is important -- that's why we intend to continue our genetics investigations.

PLEASE DON'T WRITE FOR SWEET TREES

The war put this work in abeyance for the duration. We must now begin to test the highest producers under different environmental conditions to be sure we have INHERENTLY superior trees -- trees that produce sap with a high sugar content.

THE NEXT PAGE WILL SHOW YOU WHY WE CONSIDER THIS JOB WORTHWHILE

An 8% sugar bush would mean savings in labor, fuel, equipment,
and time, because it takes about 44 gallons of 2.2% sap,
BUT ONLY 12 gallons of 8% sap to make one gallon of syrup



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- Downs, Albert A. and William E. McQuilkin Seed production of southern Appalachian oaks. Jour. Forestry 42(12):913-920.
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- Shirley, Hardy L. Review, "Woodland opportunities on dairy farms in New York", by Hugh A. Johnson, I. F. Fellows, Donald Resh, C. R. Lockard, and C. E. Behre. Charles Lathrop Pack Forestry Foundation, 35 pp. 1944. Free America 8(2):19-20.
- Forest depletion and opportunity in the Northeast. The Carpenter. Sept. 1944.
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- Buttrick, John The use of aerial photographs in forest surveys. A selected bibliography. Mimeo. June 1, revised Oct. 1, 1944.
- Division of Forest Economics Forest inventory summaries, prepared for each of following Pennsylvania counties: Carbon, Columbia, Dauphin, Lackawanna, Lebanon, Luzerne, Monroe, Montour, Northumberland, Pike, Schuylkill, Sullivan, Susquehanna, Wayne, Wyoming.

Processed (continued)

Division of Forest
Economics

Blue line prints (1" = 1 mile) are now available for the following Pennsylvania counties (price list on request):

Land Use: Carbon, Columbia, Dauphin, Lackawanna, Lebanon, Luzerne, Monroe, Montour, Northumberland, Pike, Schuylkill, Sullivan, Susquehanna, Wayne, and Wyoming.

Forest Condition: (saw-timber, cordwood, and unmerchantable forest areas): Dauphin, Lackawanna, Lebanon, Monroe, Montour, Northumberland, Pike, and Schuylkill.

Requirements, Products
and Supply Surveys

Quarterly reports on factors affecting lumber production. Restricted reports. For Maine; N. H. and Vt.; Mass., Conn., and R. I.; New York; Penna. and N. J.; Md. and Del. Mimeographed for war agencies concerned with lumber production.

.....

Quarterly reports on lumber stocks at sawmills.

.....

Monthly reports on lumber production in the Northeast.

Schnur, G. Luther

Lumber production trends, Northeastern States 1943. Occasional Paper No. 6. 24 pp.

Station Staff

Northeast forests in the postwar period. 11 pp.

.....

A forest research program for the Northeast. 13 pp.

Westveld, M.

Forest management as a measure for controlling the spruce budworm. Address, Maine Timberland Owners Committee meeting, Bangor, Maine. 4 pp.

.....

Possible role of forest management in combatting the spruce budworm. Canadian Pulp and Paper Assoc., Woodlands Section. Index No. 723 (F-3).

ALLEGHENY FOREST RESEARCH ADVISORY COUNCIL*

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Abel Wolman	Professor, Johns Hopkins University, Baltimore 18, Maryland
Hardy L. Shirley, <u>Secretary</u>	Director, Northeastern Forest Experiment Station, Bankers Securities Bldg., Philadelphia 7, Pa.

* The Council is listed as of 1944. It is now being reorganized to provide proportionate representation from New York and the New England states.

SIZING UP THE JOB AHEAD

Commercial forests occupy 61 million acres in the 11 northeastern states or 54 percent of the total land area. From them is harvested annually about 2.5 billion board feet in lumber, poles, piling, and props plus about 6.4 million cords in pulpwood, chemicalwood, fuel and minor products. This falls far short of meeting the 7.7 billion board feet of saw timber required by the territory each year, and meets only 87 percent of the cordwood needs. Current growth is estimated at 3 billion board feet plus 14 million cords; potential growth at 9 billion board feet and 18 million cords. Growth is low because so much of the land is covered with young forests, is poorly stocked with growing trees, and poorly managed. Growing stock is distributed as follows:

	<u>Acres</u>	<u>Percent</u>	<u>Volume per acre</u>	
			<u>Feet B.M.</u>	<u>Cords</u>
Saw timber stands	23,717	39	3,110	7.75
Cordwood stands	16,319	27	475	6.75
Restocking areas	12,481	20	24	2.0
Non-restocking areas	8,302	14	3	.26

The reason much of this growing stock is present is because of its low quality and inaccessibility; not because the owners are consciously attempting to build up forest productivity.

The real job confronting the forestry profession and the timberland owners of the Northeast is to release the shackled growth capacity of our forest land, and to make sure that the timber that is grown finds its highest use. This requires the adoption generally of good forest practice, the restoration of growing stock to the level that will produce optimum returns, and the restocking of non-producing lands. It requires also applying modern techniques by wood-using industries.

This task is easy to state, difficult to accomplish. It is the task of forest research to uncover the difficulties and work out measures by which they may be overcome. To attack this task we must know first the physical condition of the forest land by making an over-all survey. This must be accurate enough in detail to show where the forest land and timber volumes are located by forest types, volume-per-acre classes and species. It must also include data on present and potential timber growth, normal forest drain through cutting and loss by fire, wind, insects and disease. These should be compared with present and future timber requirements of the region.

As most of the forest land, 55 million acres, is in private ownership, forest research must next determine to what extent private owners can be expected to apply the forestry measures required to build up forest productivity to the desired level. This is a very intricate and involved problem. It covers silviculture, forest economics, owner intent, and the facilities available to carry out the owner's wishes. As a premise it may be assumed

that private owners will manage their forest lands well provided they are convinced that this brings them the highest financial returns, both short term and long term. Financial returns depend in part upon timber yields. These vary by forest type, stand density, composition and age, site quality, and the type of silviculture applied. Here again it is easy to state the problem -- but it requires a large amount of meticulous research to marshal all these facts together so that predictions can be made with confidence as to what a given stand will yield in terms of timber growth to offset management costs. The costs involved in timberland ownership and in various degrees of applied silviculture must be balanced against the monetary returns to be expected in each case. Such studies can of course be worked out on a theoretical basis, but unless their reliability is demonstrated through years of tests on actual forest properties they must be accepted largely on faith or rejected entirely. Too many owners do the latter.

Returns from forest management depend on a ready and dependable market for products and on the availability and willingness of timber operators to apply the cutting practices the owner desires. These problems are simple for a large integrated lumber and pulp company that hires its own forester and loggers and provides its own market. They are almost insuperable for an owner of a 40-acre woodland. In the Northeast 58 percent of the forest land is estimated to be owned in holdings of less than 5,000 acres. These are too small to justify hiring a full time forest manager. The owners are confronted with inaccurate knowledge of timber values, growth rates, and yields from different cutting practices, uncertain markets for forest products, timber operators demanding a free hand in cutting, few public or private foresters to whom they can turn for aid and advice, and widely fluctuating markets for forest land stocked with young timber should circumstances force a sale. It is little wonder therefore that the majority of them feel little obligation to keep their land permanently at a high level of productivity or to supply continuously products for local industry and support to local labor. Moreover, these conditions vary widely from place to place. All these and other difficulties need to be recognized, appraised against efforts now being made to overcome them, and new measures suggested and tested on a small scale to determine their effectiveness.

Neither owners nor operators, workers nor the public, are well served unless the timber that is grown is put to its best use. This means that trees valuable for veneer, furniture, or handle stock should not be used for pulpwood, mine props, or furnace poles. It means also that new skills should be developed all along the line in the woods, the mill, and the factory to the end that wood is made more useful and its products made better, cheaper, and more abundantly than they are today. This is the foundation upon which markets for timber, jobs for workers, profits for industries, and abundance for consumers depends.

Finally, a study needs to be made of the forest land owners themselves to determine objectives of ownership, their financial ability to handle forest land, their knowledge of forest practice and of investment opportunities forest management provides, and the type of approach that will be needed to persuade them to practice good forestry. Knowing intimately the forest condition, the results of applied silviculture, the costs and returns from forest land management, and the characteristics of owners, a comprehensive

forest program can then be formulated. This does not mean at all that forest programs by public and private agencies already under way should be set aside, or that carefully thought out new policies should be held in abeyance while such research is under way. In fact, it is only by trying a number of new programs such as the farm forestry program, the Timber Production War Project, and others that "clinical" material for research analysis is made available. But it does mean that high dividends can be expected from well-planned, comprehensive research covering the fields enumerated. In no other way can a sound policy be formulated for determining what lands should be transferred to public ownership and what lands will receive good management in private hands. Only such studies together with studies of the public values of forests for recreation, wildlife, and watershed protection can lay a firm foundation for determining whether public subsidies to private owners are justified and how large they should be. Only by acquiring and applying full knowledge of the biological, engineering, economic and human elements involved in the growing, harvesting, marketing and using of forest products can we expect to enjoy 80 to 90 percent of the productive capacity of our land.

The values at stake are great. Northeast forest products today have a roadside value of \$90,000,000. This can be increased three to fivefold. The research needed, though five times the current effort, will cost a very small percentage of these values. The magnitude of the task and public interest involved justifies public expenditures.

We can let things drift while our forest resource dwindles further and more and more industries starve, or we can grapple earnestly with the task, nor slacken our effort until 80 to 90% of potential returns are realized from our forest resources. Americans are noted for the courage and resourcefulness with which they attack difficult tasks and those requiring years to complete. As our country's future greatness will depend in large measure upon the wisdom and skill with which we manage our great renewable resources we should not shrink from a bold and effective forest program.

FOREST MANAGEMENT

Work during the year was a combination of war jobs, maintenance of projects and planning a peacetime program. Several more men were drawn into the armed forces. All branch stations remained closed except the Beltsville laboratory and the Lebanon Experimental Forest in New Jersey. The Kane Experimental Forest was opened for about a month in connection with maintenance of harvest cutting plots and special studies.

Through careful organization of war work, which consists largely of routine products supplies surveys, occasional special short-term products studies, the census and service and inspection of fire danger meters along the coast, staff men have found the time to undertake several jobs in preparation for a resumption of research work after the war. Without doubt war jobs have stimulated research thought and pushed practical problems to the forefront. They have given us a better grasp on logging and milling problems and caused us to scan the whole forest resource picture with reference to what could and should be produced under forest management in our territory.

Cutting Guides Revised

Such work showed the need for cutting guides that could be used by farm woodlot owners and operators both during and after the war. Early in 1944 these guides were printed as a single pamphlet and given wide distribution. They were in great demand, and the supply was soon exhausted but some criticism was leveled at the policy of sending material for all six forest types to all parts of the northeast region. Some errors and omissions were discovered. Hence the material was re-vamped into six separate leaflets and the new guides (January 1945) will be given wide distribution.

Forest Practice Rules

Management men have given considerable time and thought to minimum forest practice rules for all types in the northeast. Westveld continues as chairman of the Silviculture Committee of the New England Section, S. A. F. which issued during the year a set of recommended forest practice standards for New England. The Allegheny Section S.A.F. has a committee for formulating similar practice rules on which Little serves for New Jersey and Taylor for Pennsylvania. This committee will have a set of preliminary recommendations ready for the February meeting of the Section. Woods tests were run on the Region 7 practice rules and, in cooperation with Region 7, recommendations were made to the Washington office for possible further tests and changes. All of these so called rules are, of course, merely suggestions and express the best combined thought on the subject by the groups designing them.

Planning the Postwar Program

The service-wide job of assisting the states in preparing plans for post-war employment in agriculture and forestry cut heavily into the time of the management staff but was well worth while. Data obtained from the states were of great assistance in preparing a regional problem analysis and over-all research program. This will serve as a general broad guide for more intensive planning of a management program. -- a job that is gradually taking shape. Plans of this nature must either be pretty general, or there must be several alternate plans, based upon several degrees of financial support. Now that New England and New York are definitely a part of our territory, such plans must also consider the many shelved projects of the old Northeastern Station.

CCC Timber Stand Improvement Work Examined

In planning for post war employment all northeastern national forest and state organizations expect to do timber stand improvement work. Region 7 requested a check on the value of past TSI on the three national forests of the Northeast. Little spent two months on this study, examining old records and maps and with the help of national forest men locating and inspecting work areas where thinning, weeding, girdling or other types of TSI were done during C.C.C. days. It is a satisfaction to say that some of the unsolved silvicultural problems causing confusion in 1933 were set up then as studies at experimental forests and results are now available. The study showed the great need for selecting areas for TSI work with great care in order to obtain worth while results, and in concentrating on doing an effective job rather than on covering a large acreage per man-day. Recommendations for future work of that nature are being drawn up for use by Region 7.

Harvesting Chemicalwood

For several years the Allegheny National Forest has been thinning young stands of northern hardwoods for chemicalwood. This is an ideal method for putting 30 to 50 year-old stands into good shape to produce sawtimber. Lately the program was accelerated with CPS labor and the Station was asked to check present methods for possible improvement. Accordingly a short study involving 30 temporary plots was made and recommendations will soon be forthcoming from the data. It appears that not only the growth of reserved stands is accelerated by this chemicalwood thinning but the composition with respect to tree vigor, class of bole, and species is improved as well. Some general rules for selecting the reserve stand and recognizing tree vigor will be included in the report.

Northern Hardwoods Handbook

Research data on all types are fragmentary and often difficult to lay one's hands on in usable form. Woodland owners, farm foresters and extension men, need a silvicultural handbook. Work on one for northern hardwoods was started during 1944 with the examination of some 25 "cases". The handbook is to be put together in looseleaf style and will be based largely upon these cases. Each case is a typical stand of northern hardwoods, a little different from the next case in composition, site or age. The stand is described, tallied, photographed and given several possible treatments, from the best (and possibly least economical) to the crudest of silviculture. As new cases are discovered they will be added to the book and it will be expanded to cover typical conditions in all parts of the northern hardwood region. Similar books are planned for other types. Eventually economics and products aspects will be taken up for each case and the book gradually converted into a Forest Management Handbook for northern hardwoods.

Spruce Budworm Project

It will be noted that nothing is said of the spruce budworm in the Annual Report for 1943, yet during the past 10 months this project has developed into one of the major activities of the station. Since July active work in the field has been under way in both Maine and Canada.

The insect is defoliating spruce-fir forests in Canada at the rate of 5 to 10 million cords a year. The outbreak is nearing the Maine borders and if it strikes with anything like the force it did in certain parts of Canada the pulp industry in Maine may be relegated to a minor league status. Maine's spruce-fir forests haven't yet recovered from the budworm epidemic of 1910-19 when some 40 percent or 27 1/2 million cords of pulpwood were killed by the insect.

Two committees have been formed: (1) an over-all research committee composed of various state, school and federal officials of which Westveld is co-chairman with MacAloney of the New Haven Forest Insect Laboratory and (2) a committee of timberland owners. Both committees cooperate and coordinate their work with the Canadians and with each other.

Three methods of controlling the insect have been proposed (1) biological, (2) insecticides and (3) forest management. Entomologists of Canada, Maine and the U. S. Bureau of Entomology are cooperating on the first two methods and the Northeastern Station, with the assistance of entomologists, state forestry officials and private timberland owners is developing the third.

The management work is threefold, consisting of:

1. Furnishing information to private timberland owners directly to help them plan operations so as to cut over just as many as possible of the highly susceptible stands before the budworm becomes active within our borders. Susceptible stands are those containing high concentrations of mature balsam fir. There may be time enough for a good deal of this as entomologists estimate that it takes at least five years for the budworm to build up to destructive proportions. It is estimated that Maine, in the next 5 or 6 years, would cut over about a million acres of pulpwood land. If this is concentrated on stands most susceptible to budworm attack it may save the state millions of dollars.
2. Assisting timberland owners to start on the short cutting cycle selection type of management resulting in more vigorous and resistant stands. This type of management leading to higher yields was described in last year's annual report. It develops exactly the kind of stand believed most resistant to budworm attack and at the same time results in highest yields.
3. Establishment of sample plots cut to specifications for budworm resistance, others having reserve stands varying from highly resistant to highly susceptible to budworm attack, located in several parts of Maine to serve as guinea pig areas. If the budworm attacks in Maine it will probably cross some of the plots and valuable information will be obtained. Canadian data are not fully applicable as they must be based largely on white spruce rather than red spruce. Several such sets of plots were established in 1944 on a study area embracing nine townships. This was set up in Washington County, Maine, through the cooperation of three timber companies and the Maine Forest Service. Other such areas will be set up in central and western Maine.

During the spring of 1945, when the insect is active, much work will be done in Canada along the front line of attack.

Spruce-fir Handbook

The urgent need for haste in developing the spruce budworm program prevented Westveld from completing the manuscript for his spruce-fir management handbook in 1944. This may be completed in preliminary form by April 1945. The budworm program is furthering the very type of silviculture advocated by the handbook. It is a paradox that urgent calls from the field for help in putting silviculture into effect, prevent the writing of directions for effective silviculture.

Fundamental Studies

During 1944 work continued on the general program of planting, seeding and nursery techniques involving the use of growth regulators, protective coatings, and nutrients applied to develop methods of pre-conditioning, stock

storage, nursery practice and seed handling. Studies of tree wounding and the testing of fertilizer constituents continued. Considerable success was had with mulch treatments in revegetating sterile banks and this is being followed further. Protective coatings of lanolin and commercial wax increased over-winter survival of loblolly and red pine by 25% in the late fall plantings, but these treatments were ineffective for early fall plantings. Root pruning studies showed significant increases in field survival of loblolly and red pine resulting from pruning at both 4" and 7" depths.

Many studies are being summarized in the form of progress reports and manuscripts for publication as plans develop for gradually converting the program to one putting more emphasis on the development and management of the Beltsville Experimental Forest.

Genetics

Genetics research during 1944 was almost entirely on a maintenance basis. Most important under present conditions is the maintenance and study of the approximate 15,000 seedlings resulting from controlled breeding, and summarization of past breeding work.

1. Hybrid progenies have now reached the age (3-5 years) where they are beginning to show wide variation in vigor and in taxonomic characteristics. Of particular interest at this age are the hybrids between grey birch (female) and white birch (male). We have approximately a thousand of these hybrids. Although there is an extremely wide range in leaf and stem characteristics, all but a very few strongly resemble the male parent. Wood turners in the northeast claim there is considerable variation in the turning quality of the wood from different white birch trees. They also observe that the best trees are somewhat different in appearance from the average white birch. Our breeding results indicate the possibility that such difference in wood quality, if they are correlated with taxonomic difference, may be the result of natural hybridization. These grey X white birch hybrids may include some trees with outstanding wood qualities. The inherent quality of such trees could be maintained by propagation from cuttings.

2. Work has been long under way with poplars. In the original plantation in western Maine some of these hybrids have attained heights of 60 to 70 feet and diameters of 12-16 inches in 16 years; native poplars during the same period grew to only 30-40 feet and diameters of 4-6 inches. Over a hundred of these most vigorous hybrids, in striking contrast to hundreds of their neighbors in the plantation, show no evidence of the new canker disease which is very serious on some of the 50 hybrids which have been distributed for field tests in the past. The best of these disease-free individuals have been selected for clonal propagation and tests for resistance to this new disease.

3. Summarization of data taken at the Hopkins Experimental Forest during the 1941 maple sugar season indicate a wide range between individuals in percent sugar in the sap. The seasonal average sugar content in the raw sap of the poorest tree was 3%; the best tree averaged 8%. The uniformity of these open-grown trees in respect to age, crown form, crown size and

site, indicates that the difference in sugar content may be in large measure an inherent characteristic. Since the raw sap from the average sugar bush averages about 2.2% sugar, an 8% tree has exceptional promise.

4. Greenhouse experiments during 1944 with hybrid poplars grown with and without grass in nutrient solutions, have confirmed the conclusion based on earlier work that the inhibiting effect of grass is more than mere competition for water and nutrients. The grass apparently exerts a toxic effect, either directly through its living or dead roots, or indirectly through the organisms (bacteria or fungi) which are normally associated with the grass rhizosphere.

Oak-Pine

The Beltsville forest tract offers a challenge to the silviculturist. It lies in Prince Georges County which produces about \$180,000 worth of forest products as compared to some \$600,000 worth in each of the counties of Worcester and Wicomico where loblolly pine is king, or over a million dollars worth in Garrett County which has good stands of hardwoods. Prince Georges County is 40% forested with stands that are almost 80% hardwoods, but it has a stand of only a little over one thousand board feet per acre, and is growing at only 40% of its capacity. The Beltsville Forest is fairly typical. Renovation of this property into a producing forest will be a slow process at best, but an interesting one.

Little work was done on the forest property until this year when a start was made on cruising and mapping by C.P.S. assistants. As help becomes available this type of work will be stepped up. Studies will involve the rate of growth of present stands, the conversion of poorly stocked stands of undesired species to better composition and heavier stocking, the planting or seeding of burns, treatment and development of Virginia pine and possibilities of conversion to the more satisfactory loblolly or shortleaf pine type, changes in soil fertility of barren clay areas, and of the common abandoned farmland as they change to forest stands, methods of controlling sprouting and a variety of other related problems. Cooperation with the Maryland State Forestry Department in fire protection and silvicultural studies is already in effect and several experiments have been installed on state land.

Since Maryland passed its Forest Conservancy Districts Act the Commission of State Forests and Parks has issued a set of minimum cutting rules. Tests of other methods of cutting for the various hardwood mixtures and Virginia pine found in the vicinity of Beltsville will be watched with interest.

Considerable of Little's time during the year was taken up with assisting Taylor on state postwar plans, in working up the data for the Station's postwar program and in studying the results of past CCC timber stand improvement work on three national forests. Little prepared a detailed plan for postwar research in the oak-pine type of New Jersey, Delaware and Maryland and submitted two papers for publication, one on controlled

burning in South Jersey, in joint authorship with the Assistant State Forester of New Jersey and one on fire danger in relation to fuel types. He is now completing a paper on New Jersey's forest fire problems and working on a T.S.I. handbook for Oak-Pine.

Results of his study of fire danger in relation to fuel types have been prepared in digest form for the popular section of this report. Controlled burning results show that fire is the cheapest and most effective method tried to keep pine on pine land in South Jersey.

Plans for new work in the oak-pine type and for picking up old work now on a maintenance basis, are in better shape than for other types.

Fire Research

Little has continued to inspect a series of fire danger stations established along the coast from Long Island to Cape Charles, Virginia, and has also done some spare time research on fire damage in South Jersey. This year the Station developed and submitted a plan for a large scale attack on the forest fire problem in the Northeast.

At present more money is spent on forest fire control than for any other forestry activity in the Northeast. Expenditures and fire losses total at least \$4,000,000 annually and nothing is spent on studies aimed at reducing this loss. Certainly all plans for the future of forestry including forest research itself must assume that there will be adequate fire control and that where it is essential to the renovation of ruined forest land, -- absolute fire control.

FARM FORESTRY

In the fall of 1943 headquarters for this Fuelwood Utilization Project were moved to Pine Meadow, Connecticut, to be near woods labor employed by the state. Plans for working with a tractor, cable and power saws and for cutting cordwood by various silvicultural methods were complete but before much of a start could be made the labor vanished in the direction of war plants.

Cunningham demonstrated a power saw before some 60 interested woodlot owners and others and obtained additional data on use of other mechanical contrivances. An occasional paper is in preparation on the trend toward mechanization of cordwood production.

Having no labor for this type of work, two studies were developed that could be handled without hired help. Cooperation of a sawmill man who controlled the operations of over 20 small portables, was obtained and a logging and milling study run on a typical Connecticut woodlot. The trees were numbered and followed through the whole operation from under-cutting to sawing into products. Management and Economics cooperated on both field and office work. A report on this will soon be available.

Cutting methods used in Connecticut's woodlots are anything but efficient as a rule. Results in terms of minimum economical tree size and use of tools based on a well known mill man's operation could influence a great many operators in southern New England. Other similar studies are planned for woodlots having different types and conditions, or for a different set of products.

A preliminary study of reasons underlying the methods used in cutting Connecticut's woodlots is nearing completion. This involves contacts with the land owner and the operator who cut the woodlot and an examination of the woodlot itself. Data obtained include reasons for selling, method of payment, volume removed, condition of woodlot before and after cutting and views of both operator and owner, on forestry. This study may later be expanded to cover a larger sample than the present one which involves only 50 woodlots.

Other phases of the Farm Forestry research program include the development of an improved wood burning heater on the order of the Charwood, and a new type portable charcoal kiln, both of which are being handled by the Connecticut Agricultural Station, and the development of new types of power saws and power machinery for use in operating low grade small sized stands. The latter is a project of the Northeastern Wood Utilization Council as well as of the Connecticut State Forester's office. Probably little progress will be made on the testing of new methods of harvesting such stands until labor is again plentiful in the woods.

FOREST PATHOLOGY

(Bureau of Plant Industry, Soils and Agricultural Engineering)

Two major projects have been brought to a close by publication of the results.

The first, Decay in Balsam Fir in New England and New York, Department Technical Bulletin 872, may be summarized as follows:

In an investigation of decay and resultant cull of merchantable timber in balsam fir (Abies balsamea (L.) Mill.) from eastern Maine, northern New Hampshire, and the Adirondacks in New York, more than 1,100 trees 40 years of age and upward were dissected and the data analyzed to show the relation of cull to age, diameter, site factors, and growth rates. Decay severe enough to cause cull affected half the trees at 72 years and all at 165. About one-fourth of the total volume of all trees was culled.

Most of the cull was due to three decays: Top rot, caused by Stereum sanguinolentum Alb. and Sch. ex Fr.; brown butt rot, by Polyporus balsameus Pk.; and white stringy butt rot, by Poria subacida (Pk.) Sacc. The first caused 54 percent of the total cull, the second 13 percent, and the third 28 percent, the remainder being due to miscellaneous fungi and form defects.

The butt rots appeared at about 40 years, were present in half the trees at 72, and caused some cull in half the trees at 105. Top rot began at 40 years, was present in one-fifth of the trees at 90, and usually caused much more cull than the butt rots. Butt rot severe enough to cause cull weakens the

trees and makes them liable to windfall. This becomes so serious a matter that at about 70 years it appears to be the decisive factor in determining the proper rotation for this species.

No reliable external indications of decay were found. Figures are given for making cull corrections of gross-volume cruise estimates, but no sanitation measures are recommended under present conditions in the forest.

In the management of balsam fir for pulpwood the following measures are recommended. Present merchantable stands, which are largely overmature and highly defective, should be harvested to prevent further heavy loss. Considering losses from decay and windfall, the best cutting age appears to be about 70 years, with 80 years as a maximum. At these ages an average diameter of 8 to 9 inches is attained in unmanaged stands such as those investigated. These diameters may be considerably increased by silvicultural measures favoring the maintenance of a good and uniform rate of growth, and apparently without any increase in cull loss on a percentage basis. A rotation of about 70 years will keep cull losses at a relatively low figure, and at the same time produce trees of economical size for pulpwood. To avoid excessive losses between cuts the maximum cutting cycle should be about 20 years. In young stands, weeding and the girdling of dominant worthless hardwoods, to prevent severe suppression and induce a uniform rate of growth, should result in a minimum of cull up to 70 years.

The recommended short cutting cycle agrees with the results of silvicultural studies. It will result in relatively young stands, which are desirable in reducing damage by the spruce budworm.

The second project, Decay of Logging Slash in the Northeast, Department Technical Bulletin 876, gives the following results:

The average periods required for slash to disintegrate are 15 years for hardwood, 17 years for eastern white pine, and 29 years for red spruce. Under the most favorable conditions for decay, these periods may be shortened by about one-fifth. Unfavorable moisture and temperature conditions retard decay, in some cases by many years. Hundreds of fungi help to disintegrate slash, but about 50 cause the decay of the greater part.

The primary factors controlling the work of the slash-decay fungi are moisture, temperature, and the decay resistance of the wood. Wood decays only when moist, but since fungi need air also they cannot work in wood that is entirely waterlogged. The decay fungi make little or no growth at temperatures below 40° F. and need temperatures of 70° or above for most rapid decay. There are great differences in the inherent resistance of wood to decay; heartwood of the more durable species decays much more slowly than sapwood of any species. Slope, aspect, altitude, and soil type are important in their effect on moisture and temperature but unfortunately cannot be changed to any extent by man. The primary factors, however, may be changed by proper forestry operations.

A short rotation results in less slash per acre and a larger proportion of the fast-decaying sapwood, with consequent early reduction of the slash volume to a relatively safe point. Because broken crown cover maintains

more uniform moisture conditions, partial cutting usually favors rapid decay of slash. Clear-cutting, on the other hand, results in high temperatures and unusual dryness and is likely to retard decay.

Scattered slash decays faster than piled or windrowed slash under most conditions. Lopping the slash of conifers and of the more durable hardwoods favors decay, but its high cost must be carefully balanced against its advantages; it is to be avoided on wet sites and for species that waterlog easily. Local conditions will largely dictate the choice of methods of cutting and of slash disposal. In making partial cuttings, care is needed to keep logging injuries to residual trees at a minimum and thus prevent fungus damage by trunk infections.

Independent ratings showed a close correlation between volume of slash and fire danger. Graphs accompanying this bulletin show the reduction of fire danger with increasing age for slash of hardwoods, eastern white pine, and red spruce.

Studies of incipient decay and discolorations in veneer have been made for beech, yellow birch, sweet gum, Sitka spruce, and mahogany and khaya. Frequency of occurrence of each potential defect was determined in the veneer cutting mills, and their effect on toughness of the wood ascertained by suitable tests.

Current work is under way on Strumella canker of oaks, collar rot of several hardwoods, canker of hybrid poplars and beech Nectria disease.

FOREST ENTOMOLOGY

(Bureau of Entomology and Plant Quarantine)

European Spruce Sawfly (Diprion hercyniae (Htg.)).--Reports indicate that although this insect could be found in many of the spruce forest areas in the northeastern states, apparently there was no appreciable increase in infestation noted during 1944. It was reported that the larval disease was not so prevalent as in 1943.

The redheaded pine sawfly, Neodiprion lecontei Fitch, continued in outbreak proportions in many plantations of jack pine and red pine through the northern counties of New York. Late in the season heavy infestations were found in two plantations of jack pine and red pine in Delaware County by New York Conservation Department employees. One 30-acre plantation, composed of 90 percent jack pine and 10 percent red pine, had about 60 percent of the trees partly defoliated. It was determined from studies that in northern New York there was only one generation of this sawfly there in 1944. In many of the plantations the heavy infestations were more or less spotty; that is, severe damage was confined to certain parts of a plantation, whereas in other parts little or no feeding has occurred. In a cooperative experiment complete control of this insect was obtained in two plantations of red pine in northern New York by a solution of DDT sprayed from an airplane.

Diprion frutetorum (F.).-- This sawfly is prevalent in many plantations of red pine and Scotch pine through the northeastern states. The infestations apparently are on the increase in some localities. In a 50-acre watershed planting of red pines, 28 to 30 years old, in Southington, Conn., this insect has been abundant during the past several years, and although there has been no complete defoliation the canopy in some parts of the stand has been thinned enough to let in sufficient light to favor a dense growth of weeds and shrubs. In these areas, also, some trees have been attacked by bark and sawyer beetles and are now dead or dying. Three infested plantations of red pine, about 30 years old, in Litchfield, Co., Conn. were used for experimental tests of the effectiveness of different solutions and distribution of DDT from an airplane in September 1944.

The red pine sawfly (Neodiprion n. sp.), was abundant again in 1944 on large red pines of natural reproduction near Ausable Forks, N. Y. The heaviest feeding noted was in an area just southeast of the village. Due to wartime conditions no surveys of the infested areas in Massachusetts and New Hampshire were made in 1944.

The mountainash sawfly (Pristiphora geniculata (Hartig)) was reported as abundant on mountain ash in some localities in New Hampshire and Vermont in 1944.

Spruce Budworm, Archips fumiferana (Clem.).--Although the spruce budworm is present in the northeastern United States only in very limited numbers-- 5 larvae and 1 pupa were reported from Maine in 1944--studies of the insect and the causes leading up to outbreak conditions were actively carried on. During August ecological conditions and defoliation injury were studied intensively in Ontario by representatives from the Division of Forest Insect Investigations and the Forest Service. Forest management studies were initiated in Maine preliminary to instituting an Action Program designed to reduce the volume of trees favorable to budworm attack. Experimental work on the control of the budworm by insecticides distributed from airplanes was also carried on in Ontario.

Anisota rubicunda (Fab.) and Anisota virginiensis Drury.--Reports were received that caterpillars have been defoliating sugar orchards in the northern part of Derby, Vermont, for the past several years and that many trees were dead or dying. An investigation made in cooperation with the Division of Plant Pest Control of the Vermont Department of Agriculture disclosed that the green striped maple worm (A. rubicunda) was responsible for most of the defoliation on sugar maple and that infestations of A. virginiensis were rather general on beech growing in the same stands. A cooperative experiment in artificial control, which consisted of spraying with both cryolite and DDT from an airplane, appears to have been highly successful. It will be necessary to make some observations next season to determine the after-effects.

The orange striped oakworm (Anisota senatoria A. & S.) was generally abundant in oak woodlands through Middlesex and New London Counties, Connecticut. Defoliation of red and scarlet oaks was particularly noticeable, and to a much lesser degree on black and white oaks.

Cankerworms, especially the fall cankerworm (Alsophila pometaria Harris), were very abundant in many localities through New Haven and Fairfield Counties, Connecticut, and in the southeastern part of New York. Spraying activities were greatly curtailed because of manpower shortage and war-time conditions, with the result that many shade and fruit trees were necessarily neglected, and were severely defoliated by this insect in 1944.

The Eastern tent caterpillar (Malacosoma americana (Fab.)) was very abundant on apple and wild black cherry through southwestern Connecticut in the spring of 1944.

The fall webworm (Hyphantria cunea Drury) was generally heavy through most of the Connecticut River Valley from Long Island Sound north through Massachusetts. Many roadside and hedge row trees, particularly the wild cherries, apple, elm and hickory, were badly defoliated.

The Satin Moth (Stilpnotia salicis (L.)).--The Superintendent of Forest Pest Control, New York Conservation Department, investigated a report of insect damage to Carolina poplars in Delmar (Albany County), N. Y., late in May 1944 and found the satin moth severely defoliating some 15 to 20 large shade trees. Apparently this is the first record of the satin moth in that state.

The larch casebearer (Coleophora laricella Hbn.).--Throughout northern New York infestations of the larch casebearer were very noticeable in 1944. Generally the infestations were light to medium, and where heavy defoliation occurred it was extremely local.

The lilac leafminer (Gracilaria syringella Fab.).--Injury by this leaf-miner was very noticeable on lilac in Potsdam and vicinity, N. Y., early in June 1944.

Lambdina athasaria pellucidaria (G. & R.).--It was reported there were many moths during the latter half of May 1944 in the red pine plantation at North Branford, Connecticut, where this looper caused severe defoliation in 1942 and 1943. Few larvae matured, however, and the infestation has now subsided. Various bark and wood boring beetles, including Ips grandicollis, Dendroctonus valens, Pissodes approximatus and Monochamus sp., which normally attack trees in a weakened condition, have become active in the trees in the area most heavily defoliated and many trees are now dead or are in a dying condition.

The elm leaf beetle (Galerucella xanthomelaena (Schr.)) was abundant in many localities through New Haven County, Connecticut, in 1944. Medium to heavy infestations were also observed in Washington and Columbia Counties, New York, but the infestations generally were spotty and in villages or cities.

The Alder Flea Beetle (Altica bimarginata Say).--Severe infestations of this flea beetle were observed on speckled alder in July in many localities through eastern parts of Maine.

Blepharipa rhois Forst.--Adults and larvae of this insect completely defoliated several large bushes or small trees of staghorn sumach late in August and early in September 1944 at North Branford, Connecticut.

The Bronzed Birch Borer (Agilus anxius Gory).--This insect was abundant in stands of paper and yellow birch through much of Maine. The work of this insect was most noticeable in stands where the trees may have been weakened by other causes.

Corythuca ulmi O. & D.--This lacebug caused serious browning of elm foliage in several localities in Litchfield County and in one area in the town of Southington, Hartford County, Connecticut, during July 1944.

Pineus pinifoliae Fitch.--In Franklin and Clinton Counties, N. Y., the cone-like galls of this insect were abundant on red spruce, particularly in the vicinity of Union Falls and Hawkeye, in June 1944.

The Beech Scale (Cryptococcus fagi (Baer.)).--In the White Mountain National Forest, New Hampshire, this insect was found dispersed over a much wider area than in 1943. There are heavy concentrations of the scale in some localities; however, no mortality of beech trees in these areas has been reported.

Termites.--Numerous inquiries concerning termites and their control were received at all times through the year. Many specimens were received. The majority of the inquiries came from localities in Metropolitan New York and on Long Island.

FOREST PRODUCTS

With the beginning of Fiscal Year 1945 the Station embarked on a new field -- wood utilization service. Actually, it was not entirely new, inasmuch as we have been carrying on a number of activities closely related to this as a part of our farm forest research programs in Connecticut and at Cooperstown. Also, the Station has been obliged from time to time to answer a great number of requests involving wood utilization and industrial locations. The service was slow to get started, largely because of the difficulty in recruiting personnel during the current war period. Men having the desired qualifications are extremely hard to find. The Station is fortunate, however, in now having three able men on this job, two with a forestry background and one trained in economics. We hope eventually to have one or two additional workers, preferably trained in chemical engineering or mechanical engineering. In spite of the late start, a considerable amount of effective work has already been started. First of all, we have made a thorough canvass of the field and prepared a tentative working outline covering many activities in which we might engage. For the first year or two, work will be concentrated largely in Maine, where interest on the part of wood users is keen and dependence of the state's economy on forest products is of first importance. Studies that will be undertaken are:

(1) possibilities of using to a greater extent the hardwoods of northern Maine forests; (2) possibilities of utilizing within the next few years a large amount of balsam fir that needs to be cut to forestall heavy losses by spruce budworm; (3) what could be done to improve the quality and market value of lumber produced by Maine saw-mills; (4) adapting modern mechanization to increase logging efficiency; (5) improving techniques in the wood turning industry; (6) expanding production of high grade veneer; (7) utilization of waste materials; (8) utilization of hardwoods for pulp; (9) increased utilization of balsam fir for pulp to absorb extra cutting as a result of the budworm program; (10) formulation of problems requiring special investigation at Madison, and of others that can best be handled locally by existing research agencies.

Already the Station has answered a number of important questions involving the use of new resins and impregnating materials in wood for sash and doors, boat building, and other processes. We are now engaged on a study of the wood chemical industry to determine postwar outlooks; we are looking forward to the early initiation of studies of small panels for prefabricated housing in cooperation with industries and the Madison Laboratory. We are now preparing a logging handbook that deals with both old and new logging techniques.

Interest in the Station's program has been keen on all sides. Industries and manufacturers have shown great readiness to cooperate with the Station and to confront us squarely with the problems before them. Actually, there is a far greater market for the results of research in wood technology than existing research institutions can meet. As an example, a manufacturer of resins recently told the Station that he had a new and valuable resin for use in bonding wood, that its value had been demonstrated, but that so far he has been unable to make or to have made for him an exhaustive set of tests that would bring out all its characteristics. Announcements of other new products are being made almost daily, but each of them will require elaborate testing before they can be put into full use. All of this serves to emphasize the need for a greatly expanded program of forest products research throughout the country. Existing work at the Forest Products Laboratory, in industrial laboratories, and some of the universities, impressive as it is, cannot begin to keep up with the demands that are placed before them. It is a part of the Station's task to anticipate these demands, appraise their relative importance, and make recommendations to the Laboratory for new work that should be undertaken.

FOREST ECONOMICS

Anthracite Forest Survey

In areas where at times there is a serious maladjustment between the number of employables and the amount of work for them to do, it is but logical that the question should be raised as to what contribution the forest might make toward the solution of this problem. The question is especially natural in the Northeast, where the requirements for forest products far exceed their production and where the forests are probably growing less than one third of their potential. What work should be done

to build these forests back up to full productivity? How many men would be required? To what level can permanent employment in forest industries be raised? These are the questions which were pressed by individuals and groups in the Anthracite Region during the depression years of 1939-40 where, though unemployment has been practically wiped out as a result of the war, the prospects that it will again rise to critical proportions later on are unfortunately all too high.

A comprehensive forest program for an area such as the Anthracite Region will depend for its fruition very largely on the forest land owners. Action by public agencies, such as the CCC program, has heretofore been largely confined to public lands. Such areas make up about 16 percent of the forest land in the Anthracite Region and only about 10 percent in the Northeast as a whole. Unless private land owners can be persuaded to finance active rehabilitation measures on their own property, or legislation is enacted whereby public funds may be so expended, any rehabilitation program will fall far short of meeting the objectives of building for full productivity and of providing full employment. Plans must therefore be developed which are specifically suited to the woodland areas of each class of owner, or they will fall on deaf ears.

Forest surveys which yield over-all data for regions including 5,000,000 acres or more, and made up of many diverse interests and various natural and economic differences, fail to provide the basis for detailed planning. Even within individual counties the situation is rarely uniform. In the Anthracite Region, counties vary in size from 84,000 to 577,000 acres, and the forest types, forest conditions and ownership patterns differ in different sections of most of these counties.

The Anthracite Forest Region breaks up logically into three natural and economic areas. The nucleus of the region, the four anthracite coal fields, comprises about 400,000 of the 3,250,000 acres of forest land. The farming area, which is largely adjacent to the coal fields and almost completely surrounds them, contains a little over a million and a half acres of forest land. The remaining sections are made up of nearly unbroken forest areas which are largely uninhabited and where much of the land surface is too mountainous for agricultural use.

Nearly 65 percent of the coal field forest area is owned by coal companies, who have been principally concerned with subsurface values. With few exceptions they have allowed the surface to be clear-cut. During recent years thousands of acres have been laid waste by surface stripping for coal and the infertile subsoil has been left exposed. Fire has played havoc with this section. Although the coal field forest makes up less than three percent of the forest area of the state of Pennsylvania, more than 30 percent of the state's fires and some 23 percent of the territory burned over fall within this area. At the present time over 90 percent of the forest is in unmerchantable stands, a quarter of it scrub oak and the rest largely young stands of white, red and black oak. Less than 7 percent of the growth in the region is produced by the coal field forests. As a result of the maltreatment of these forests, the coal companies are now forced to obtain most of their large requirements for mine timber from the farming and extensive forest areas.

The forests in the farming area are in much better shape than those in the coal fields. Nearly one-third of these forests are owned by farmers and close to 60 percent by other small woodland owners. For the most part they are broken up into relatively small tracts. There are few fires in this area, and the site is on the whole better than elsewhere in the region. Almost 30 percent of the forest is in merchantable stands of ten acres or larger, with at least five cords or ten tons of material to the acre. These are made up mostly of the valuable northern hardwoods and of the white pine-white oak-red oak type. Altogether these forests produce nearly 60 percent of the growth in the region.

The extensive forest area, largely located in the Poconos and in the Allegheny Plateau region of Wyoming and Sullivan counties, has the highest proportion of its area in public ownership, nearly 30 percent. Most of the rest is in the hands of large mine timber or sawmill operators, recreationists, and in large private estates. These forests are not on the whole in quite as good condition as the farming area forests, but they are still in appreciably better shape than the coal field forests. Nearly 25 percent of their area is in merchantable stands. The predominant species are the northern hardwoods, white pine, hemlock and the oaks. Upwards of 40 percent of the growth in the region occurs in the extensive forests.

The population in the coal field area averages nearly 1200 persons to the square mile. It is here, therefore, that the gravest unemployment problems are likely to develop; and it is here that constructive plans that will provide employment are most needed. Steps should also be taken to reduce the influx of waters into mines. Additional roads and trails, safety strips and towers, and a reduction of natural hazards would aid in bettering the present unfavorable record of fire prevention and control. Planting the scrub oak barrens has been suggested, but these are largely poor sites, where conversion will require many release cuttings. If these areas are protected from fire for a period of 40 to 60 years they will stock naturally with better species. The more productive stands can be improved by weedings and thinnings. Open areas around the towns should be planted to improve their usefulness and reduce a serious fire hazard. The afforestation of unsightly mine waste banks and strippings, at least in the neighborhood of towns and streams, would reduce silt blowing and stream siltation. Although largely uneconomic as a timber production measure, such a program would be of immeasurable public benefit.

The forests of the farming and extensive forest areas would benefit by timber stand improvement measures. But a great deal of such work can be handled by farmers or local woodsmen, and it is doubtful if this would provide any considerable reservoir of work for the unemployed of the more densely populated sections. In the northern portions of the area there are about 100,000 acres of unused or abandoned open farmland that should be planted to increase its usefulness. Recreational developments can be greatly expanded in the extensive forest area.

Altogether the immediate rehabilitation of the forests of the Anthracite Region will probably require about 5,000,000 man days of labor in addition to the work of farmers and local woodsmen. This program could be

largely worked out over a 5 year period, requiring approximately 5000 men each year. Unfortunately this is but a small portion of the 100,000 who will probably be unemployed in the coal field areas during the postwar period. A much broader study than this one dealing with the forests alone is needed to work out solutions for the large problem it is likely to be facing.

Forest Survey

Detailed planning for forest survey has begun in the Northeast with the assignment of Philip A. Briegleb to the Station. We expect to be ready for large scale work just as soon as funds are made available by Congress.

One of the first jobs in the Northeast is to find out what kind of forest survey the people want. How detailed should this survey be? What information should be obtained? What standards of accuracy should be maintained? For what units of area should data be made available? The answers we will receive to these and other questions are indicated in the inquiries we are almost daily receiving. Established industrialists wish to know the relationship between growth and drain in the areas accessible to their plants. Others considering industrial development want to know where they might locate and obtain adequate quantities of certain species. Returning veterans have expressed a desire to settle on the land and have sought advice in locating suitable forest homesteads. Communities concerned with changes in employment following the war seek information on the contribution forest resources can make. Other postwar planners are interested in the situation in larger areas.

One of the most pressing problems in the Northeast is the location of areas susceptible to the spruce budworm. Millions of acres have been destroyed by this insect during recent years in Canada and the spruce-fir region of the United States is threatened with invasion. Can the forest survey through its aerial photo techniques quickly locate the more susceptible areas? Over-mature balsam fir appears to attract the spruce budworm. A primary study of this problem indicates that we can definitely locate areas containing over-mature spruce and fir. It appears doubtful that we will be able to separate the fir from the spruce on the usual panchromatic aerial photographs, but the use of infra-red film with a light filter appears promising. In any case, the location of the over-mature stands would be of considerable value in pointing out those tracts which should be examined in the field to determine their composition and the control measures which should be applied to them.

All of the many demands for our forest survey data in the Northeast, indicate the need for detailed information on relatively small areas. Such information should probably be available for units as small as the average township. Fortunately the use of aerial photographs in forest survey may make it possible to offer such detailed compilations as a supplementary service to forest survey yielding data by counties. Assuming that the latter delineates the forest type and condition classes and prepares volume estimates from stand and stock tables, it would be

relatively simple to compile data for smaller units by estimating the forest type and condition areas therein and applying the proper stand and stock tables.

Some progress was made during the past year in the development of aerial photo forest survey techniques. A study of the desirable specifications for aerial photographs for forest survey was undertaken by Harvard Forest in cooperation with Fairchild Aerial Surveys. Experimental photographs were taken at various elevations with different types of films and filters and at several periods during the day and year. The Station cooperated in a study of different methods of tree height estimations from aerial photographs which indicated that parallax methods may yield estimates as accurate as those made by the shadow-length method we have been using and have the further advantage of application to more extensive forest areas and to photographs taken when shadows are obscured. Photographs taken on infra-red film with light filters distinguished sharply between conifers and hardwoods and even indicated some separation is possible between coniferous species.

In the Anthracite Region, Ferree obtained some very promising correlations between crown dimension and d.b.h. of trees whose crowns were readily measurable in the dominant canopy on aerial photographs. Heretofore, estimates of volume from aerial photographs have been made through estimating tree heights from shadow-length measurements, counting the number of visible crowns in fifth acre plots and applying a total-height volume table. Tree-height measurements have been made with a reasonable degree of accuracy, but the problem of counting the number of trees in the dominant canopy has been subject to a higher degree of error. Further exploration of the relationship between crown dimension and d.b.h. may result in greater simplification of volume estimating and forest condition classification on aerial photographs.

Forest Cooperatives

Nearly half of the 60,000,000 acres of forest land in the Northeast is held in small holdings. More than 15,000,000 acres is held by some 400,000 farmer owners; other millions of acres are held by banks, insurance companies, timber operators, recreationists, and other non-resident owners. The problem of contacting several hundred thousand owners with diverse interests, and persuading them of the true values of their woodland properties, and developing an active interest in forest management is a tremendous one. One approach to this problem is through the development of centralized cooperative forest management under owner control. Several forest cooperatives are now operating with a fair degree of success in various sections of eastern United States. One of the oldest and by far the largest from the standpoint of active membership is the Otsego Forest Products Cooperative Association of Cooperstown, New York. The development of this cooperative has been studied by the Forest Service from its beginning.

The OFFPCA is a pioneer organization and has had virtually no precedents to guide it. As a consequence it has had more than its share of difficulties. At the time it was organized, in November 1935, it was assumed

that a sizable proportion of the timber on the 180,000 acres of forest land in the area would be available to the Cooperative, and that a market could be found for the products of low-grade timber. Plans for a substantial processing plant were made on the basis of these assumptions and a series of loans obtained from the Rural Resettlement Administration and the Farm Security Administration. These agencies, which were set up to aid the low-income farmer, made the loans only on condition that members and employees of the Cooperative be largely from this group.

Delays, errors in judgment, unskilled labor, increase in the cost of materials and machinery ate deep into the reserves. When the mill finally began regular operation in October 1940, the Cooperative was carrying a debt of \$278,000, much of which had been used in effect for unemployment relief and experimentation; and it had on its roll a large number of members who had little or no timber or little or no understanding of the organization's aims or of the principles of cooperative business. Full-time production of high-grade lumber was now aimed at as the only way to liquidate the debt; but the timber resources of members proved insufficient. Products of low-grade timber could not be marketed profitably. Competitive mills with smaller overhead resumed operations in the area. Finally, the war brought on a labor shortage and an increased demand for dairy and poultry products as a result of which many members have had no time for logging.

But 1944 has been a year of great promise for OFPCA. Although still laboring under an excessive indebtedness to the federal government, OFPCA for the first time demonstrated that it could operate successfully under a reasonable capitalization. Under the able management of Leith Violette, formerly with NETSA, an alternate-day operation was maintained with the mill force handling the yard work and shipping. Nearly 2 million board feet of lumber, mostly high-grade hardwoods, were produced. About 90 percent of the production was sold outside the area bringing in almost \$100,000. Steady employment has been given to about 45 persons. This performance has encouraged the Board of Directors to seek the support of members and local citizens for a refinancing plan.

During the entire period of hectic development the most encouraging factor has been the general acceptance of the Cooperative's objective of woodland improvement. The membership has grown to over 960 and more than 30,000 acres of forest land is now under intensive management. This area bears more than 50,000,000 board feet of growing stock. The proportion of timber removed in the first cut has ranged from ten to thirty-five percent, averaging a little under thirty percent during the past two years. The proportion cut has been based on both silvicultural and economic considerations. Stands with mature timber and trees of poor quality have been cut into more heavily than the younger, better-formed stands. Consideration has been given in marking to the financial needs of the members, and the need of the mill for a reasonable proportion of high-grade logs. The Cooperative has always assured members of a square deal by strict log grading and scaling. A recent survey revealed that three-fourths of the members have a definitely favorable

attitude toward their cooperative. This survey showed further that three-fourths of the non-members in the area are interested in woodland improvement, a degree of interest that has been undoubtedly stimulated by the activities of OFPCA.

Although the Forest Service has worked very closely with the Directors and management of OFPCA during this development period and shares with them responsibility for its failures as well as for its successes, it has been principally concerned with acquiring from experience information which would aid in the development of forest cooperatives elsewhere. Some factors which affect forest cooperatives are unique, but for the most part successful development will depend upon careful consideration of the same factors as those which condition the development of any producer's cooperative.

1. People must need the services and advantages a forest cooperative can give and want one enough to organize it and keep it going. A cooperative is a member's project, they must want it enough to take an active part in getting it on its feet and keeping it there. Farmers in the Northeast are generally familiar with producer cooperatives. These are found in the dairy, poultry, maple syrup and general produce fields. Farmers, however, take all too little part in the active management of these cooperatives and it is questionable how much activity can be expected of members in a forestry cooperative especially when their contacts with it may be relatively infrequent.

Small woodland owners, like most private individuals, are primarily interested in maximum returns for their products. Their interest in their woodlands is largely secondary to their interest in other farm operations and their tendency is to welcome a centralized organization which will give them sound advice and assure them of a square deal and fair returns. Farmers also welcome an opportunity to buy finished lumber and other products needed on the farm at a lower cost and of higher quality than otherwise would be available. They are also interested in the improvement of their woodlands in order to assure a steady supply of the fuelwood, fence posts, barn repair and other materials needed on the farm. The most convincing argument for forest management, however, is one which rests its case on higher financial returns.

It is doubtful if any request would be received for advice and assistance in the development of forest cooperatives if foresters just sit back and wait for such requests to come in. Extension foresters, farm foresters and others will have to be on the lookout for suitable locations for forest cooperative developments. Technical agencies should be available to make surveys of the available forest resources, of land-owner attitudes, and of markets, and to provide local groups with advice based upon experience. They should, however, remain in the background as much as possible.

2. The availability of the forest resource must be very carefully considered. This requires not only a study of the amount of timber within a logical operating area, but also the extent to which the owners of this

timber are likely to participate in the forest cooperative if it is organized. An estimate must be made of the minimum volume of timber or other forest products which must be handled during the first and each succeeding year of the cooperative's development. Farm woodland owners in the Cooperstown area require from ten to twenty-five acres of woodland to provide annually the products needed on the farm. Only those having over ten acres of merchantable timber can in general be expected to provide the Cooperative with logs for manufacture into lumber. Although light selective cuts have been made, the Cooperative cannot expect to obtain additional logs from the areas already cut over for another 5 to 10 years. This means that during the development period a sufficient number of members must be signed up to provide the volume required until it is possible to depend upon appreciable second cuts. Furthermore, farmers cannot be expected to adhere to definite cutting cycles. It is to their advantage to do their own logging, and this is only feasible when labor is available. Many farmers look upon their woodlands as a reserved bank account to which they can turn in times of financial stress. Such periods may not coincide with cutting cycles. The market for forest products may determine when it is best to move the timber.

The competition of already-developed industries or those which may resume operation must be carefully considered. If there are adequate local outlets for the products of the area, and the operators will purchase logs cut selectively or stumpage marked for cutting it would probably be best to start with a cooperative to market logs or stumpage. OFPCA was developed at the depth of the depression and there were few competitive mills operating. Many dormant mills have resumed operations during the war. These still depend largely on clearcutting timber purchased for a lump sum.

The kind of a forest survey is also important. Aerial photographs now offer a useful tool for accurately mapping each merchantable tract, and making a preliminary estimate of the volume contained therein. Such a survey will quickly eliminate large areas which cannot contribute effectively to the development of a forest enterprise. In the Northeast, most of the forest tracts are broken up into 2 or more ownerships. It is important, therefore, to find out who owns the merchantable tracts, what their intents-of-ownership are, and what their attitude is toward the sale of timber and the cooperative way of doing business.

A survey of owners in the Cooperstown area reveals that farmers generally do not know the condition of their woodland. Many who thought they had some timber, were found to have no merchantable growing stock, while many who thought they did not have any timber were found to have merchantable stands. OFPCA has already taken into its membership about one-third of the farmers in the Cooperstown area who have merchantable timber. Those who haven't as yet joined have largely refrained from doing so because of lack of knowledge or misunderstanding of OFPCA policies or disapproval of some features in its operation. The indications are that the cooperative should be able to draw to it during the next decade an additional third of the farmers with merchantable timber in the Cooperstown area.

3. Loans should not be contingent on harmful limiting conditions. If a loan must be secured, it should be free of restrictions contrary to basic cooperative principles and well within the cooperative's ability to repay in the near future. It is better to start small and expand than too large and fail. The provision in the OFPCA loans that members and employees should be largely from the low income brackets was an unfortunate one. The use of inexperienced labor in the construction of the mill and the other plant facilities undoubtedly hampered their completion and contributed to the delay in starting regular operations. Furthermore farmers in the low income bracket or those on relief have already withdrawn as much capital as possible from their forest bank account and can make little or no contribution to the development of a cooperative.

4. Only those who can participate should be sought as members. Contacts with prospective members should in general be limited to those woodland owners who have sufficient merchantable timber to enable them to participate by providing logs and also by sharing in the finances of the business. In the case of the OFPCA a great deal of time and effort was spent in signing up members who had little or no timber and little real interest in the development of the cooperative. Furthermore, if members with substantial growing stock who can benefit financially from the development of the cooperative are signed up, they can be expected to support it financially. OFPCA members do not have much financial interest in the association; their total investment is one dollar paid for a share of common stock upon joining, plus a stock retain of 5% of the value of the logs they deliver to the mill.

Cooperation means working together towards a common goal, and every means should be used to increase the cooperation of members. They should be urged to do their own logging in order to realize the labor return available, and to cooperate with one another in handling this phase of the business. Also, because members of a forest cooperative are scattered over a rather large area, local committees should be established. These should have frequent group meetings to discuss the problems of their cooperative, to learn the techniques of logging, to clarify misunderstandings, and to develop plans for the promotion of membership. All members and prospective members should be given a clear understanding of the objectives of the cooperative and the obligations and privileges of membership. A valuable aid to any cooperative is a well edited "house organ" to maintain contacts among members and of members with the management, and to inform non-members of the opportunities the cooperative offers.

5. Good management is absolutely essential. Because members of a forest cooperative are scattered and their contacts with their cooperative relatively infrequent, good centralized management is required. Members should elect an active Board of Directors to review and control the operation of the cooperative. Good management will make arrangements for log delivery, hire skilled mill labor, and manufacture and sell high-grade products in such way as to assure to all members the greatest possible return. Without such management a forest cooperative is doomed to failure.

Forest cooperatives are still in their infancy. They are still faced with unsolved difficulties, and many obstacles must be hurdled before they

will be accepted as a permanent part of our economy. But they offer one way of spreading forest management among small woodland owners. This phase of the OFPCA operation has been outstandingly successful.

FOREST PRODUCTS REQUIREMENTS, PRODUCTION AND SUPPLIES

Lumber production and stocks surveys were continued through 1944 for the second entire year. Full use of TPWP foresters and other cooperating foresters in state and federal agencies has resulted in an effective organization for collecting field data. Better coverage of the smaller mills and the smaller states has been effected by adding some 30 small mills to the sample. Improvement of summarizing and computing methods has reduced the statistical work to a minimum.

Returns from 400 to 500 sample sawmills are receiving each month of which 54 percent are returned by mail and the remainder by telephone or personal contact. The 1942 census base of 4523 sawmill operations is used as the total population for estimating purposes. Although many changes in the mill population have occurred, it has been impossible to keep these changes up to date because of the lack of a new 100 percent sawmill census in all states. It is recognized that as more and more changes occur less accuracy can be expected from the old base and it is hoped that a new 100 percent census will be made soon.

Lumber production estimates for 1944 are 1,796 million board feet or exactly the same as estimated for the northeastern states for 1943. This is however 2.4 percent less than the census figures for 1943 which were published in December 1944. The difference is well within the 5 percent error of estimate due to sampling. Lumber stocks at sawmills decreased to 224 million feet from 285 million feet at the end of 1943 or 21 percent. With requirements greater than production the tendency will be to reduce stocks even more if possible during the coming year.

Monthly stocks surveys were started in November in order to keep a more current record for WPB. Many mills refuse to give monthly stocks records as they do not keep running inventories and they hesitate to give estimates in lieu of actual figures. Even the quarterly estimates obtained during the past two years were difficult to get from some mills. Fairly reliable estimates of lumber stocks are made, however, in spite of these difficulties.

Considerable effort was given to getting improved information concerning factors affecting lumber production during the year. Actual case data are few and hard to get. War Manpower Commission offices furnished some data from a few larger establishments. Labor continues to be the main factor which prevents increased production. In spite of labor shortages, however, production has been maintained by more efficient management, longer hours, use of more mechanical equipment, better use of equipment and improved technique in small sawmill practice. TPWP has been a big factor in maintaining production. Equipment, trucks, tires, fuel and the like have been made available in sufficient quantities for the most part. The

production per man day has no doubt increased since last year. Formal reports for six state-groups and for the northeast were prepared each quarter. The local reports were distributed to the cooperating foresters and the sample sawmills for their information, as well as to the various government agencies interested in the lumber production program. During the last three months of the year Interim Factors Reports were prepared every two or three weeks. TPWP has been particularly good in supplying timely items for these informal reports.

A number of special surveys were made also; a study of lumber prices received by small hardwood mills, an equipment survey of crawler tractors and stationary power units used at sawmills and on logging jobs, fuelwood estimates, the effect of Christmas tree production on the production of lumber, container veneer conversion factors from log scale to square feet and employment in primary wood using industries. A study of the cost of producing prime aircraft veneer logs in Aroostook County, Maine was made for us by TPWP.

Census of Lumber Manufactured

Field work for the 1943 census of lumber production was conducted along with the monthly lumber production survey. In northern New England and Maryland T.P.W.P. project foresters assisted our own R.P.S. men. Southern New England was canvassed by Station men. New York and Pennsylvania delinquent census mills were contacted by some 80 cooperating foresters doing TPWP work. The bulk of these foresters were State District Foresters. Others were Soil Conservation Service foresters, Blister Rust Control foresters, Farm Foresters and Extension Foresters. New Jersey and Delaware were canvassed by our own R.P.S. men.

Recently published census figures for the Northeast for 1943 show that the R.P.S. monthly production estimates for the year are 2.4 less than the census. This is well within the sampling error of 5 percent for the region. Some individual state figures showed differences from the census as high as +22 percent for Maine and -18 percent for New Hampshire. Though these are quite high and above the 15 percent sampling error set up per state they may still be within the realm of sampling error. Some differences in the sawmill universe, however, might tend to cause such large differences on the state level. A new 100 percent census would surely shed some light on the matter.

The problem of getting consistent results on the Census from so many co-operators as in New York and Pennsylvania, was a difficult one last year. Whether the same method can be used for a 100 percent census of sawmills is doubtful. The regular job of fire protection and management of state forests comes first for the district forester so cooperative help on the census necessarily must be done if and when time is available. Some modification of this arrangement will probably be necessary for a 100 percent census for the year 1944.

PERSONNEL - 1944

Overhead Administration

Hardy L. Shirley, Director

Hazel L. Stiles, Administrative Asst. CAF-7
Florence Cameron, Clerk CAF-5 (3 months)
Margaret R. Evans, Clerk CAF-5 (9 months)
Katherine F. McKeaney, Clerk Stenographer CAF-4
Josephine A. M. Sorrentino, Clerk Stenographer CAF-3
Anne M. Meindl, Stenographer CAF-2

Field Divisions

Bartlett Experimental Forest, Bartlett, New Hampshire
(In custody of the White Mountain National Forest)

Beltsville Experimental Forest and Laboratory, Laurel, Maryland
T. Ewald Maki, Forester P-5

Chenango Experimental Forest, Smyrna, New York (Closed)

Eastern Shore Experimental Forest, Parsonsburg, Maryland
Silas Little, Jr., Silviculturist P-3

Finch-Pruyn Experimental Forest, Newcomb, New York (Closed)

Gale River Experimental Forest, Pierce Bridge, New Hampshire
(In custody of White Mountain National Forest)

Kane Experimental Forest, Kane, Pennsylvania
Ashbel F. Hough, Silviculturist P-3

Lawrence Hopkins Memorial Experimental Forest, Williamstown, Mass.
(Closed)

Lebanon Experimental Forest, New Lisbon, New Jersey
Silas Little, Jr., Silviculturist P-3

Massabesic Experimental Forest, Alfred, Maine (Closed)

Standing Stone Experimental Forest, Manor Hill, Pennsylvania
Professor H. Norton Cope, Collaborator

Forest Cooperatives, Cooperstown, New York
Allen W. Bratton, Forest Economist P-3

Anthracite Forest Survey, Wilkes-Barre, Pennsylvania
Miles J. Ferree, Forester P-2

Farm Forestry, Pine Meadow, Connecticut
Frank E. Cunningham, Forester P-2

Farm Forestry

(Raymond F. Taylor, Silviculturist P-6, In Charge)
Frank E. Cunningham, Forester P-2

Forest Utilization Service

James C. Rettie, Technologist P-6, In Charge (3 months)

Harvesting and Initial Processing

Frederick C. Simmons, Forester P-5 (4 months)

Secondary Wood Processing and Fabrication

Roy M. Carter, Forester P-5 (4 months)

Requirements, Production and Supplies

G. Luther Schnur, Forester P-5 (In Charge)

Emma L. Warfield, Statistical Clerk CAF-3

Pennsylvania, New Jersey, Delaware and Maryland

Earl J. Rogers, Forester P-3 (2 months)

Edwin H. Weil, Jr., Forester P-1 (6 months)

Erastus P. Griffin, Jr., Forester P-1 (5 months)

Harold F. Ford, Agricultural Aide SP-6 (3 months)

New England States and New York

Victor S. Jensen, Forester P-4 (6 months)

Seymour G. Hile, Forester P-3 (5 months)

Paul E. Bruns, Forester P-3 (1 month)

Donald H. Archer, Forester P-2

Special Studies

Louis L. Lauve, Jr., Industrial Specialist P-5